RESTRICTED

Serial Nº 703

# INSTRUCTION BOOK

FOR

# NAVY MODEL RAK-8

# RADIO RECEIVING EQUIPMENT

CLASS IA, A-C OPERATED

FREQUENCY RANGE 15 - 600 KILOCYCLES

THIS EQUIPMENT HAS BEEN MODIFIED IN ACCORDANCE WITH INSTRUCTIONS CONTAINED ON ATTACHED ADDENDA

Manufactured For

U. S. NAVY DEPARTMENT BUREAU OF SHIPS

By

*The Magnavox Company*
FORT WAYNE, INDIANA

CONTRACT: NXss-21827 DATE OF CONTRACT: 14 JANUARY, 1943

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**This Instruction Book is furnished for the information of commissioned, warranted, enlisted and civilian personnel of the Navy and persons authorized by the Bureau of Ships whose duties involve design, manufacture, instruction, operation, and installation of radio, radar, or underwater sound equipment. The word "Restricted" as applied to this instruction book signifies that it is to be read only by the above personnel, and that its contents should not be made known to unauthorized persons not connected with the Navy.**

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CONTRACT: NXss-21827

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FORM EL 530 — LITHO IN U.S.A.

## WARNING

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATORS OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS REMOVE POWER, DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.
THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO BUREAU OF SHIPS MANUAL OF ENGINEERING INSTRUCTIONS, CHAPTER 31 (MIMEOGRAPHED FORM) OR SUBSEQUENT REVISIONS THEREOF ON THE SUBJECT OF "RADIO — SAFETY PRECAUTIONS TO BE OBSERVED."

## CONTRACTURAL GUARANTEE

The equipment including all parts and spare parts, except vacuum tubes, shall be guaranteed for a service period of one year with the understanding that, as a condition of this contract, all items found to be defective as to design, material, workmanship or manufacture shall be replaced without delay and at no expense to the Government, provided that such guarantee and agreement shall not obligate the contractor to make replacement of defective material unless the failure, exclusive of normal shelf life deterioration, occurs within a period of two years from the date of delivery of the equipment to and acceptance by the Government, and provided further, that if any part or parts (except vacuum tubes) fail in service or are found defective in ten per cent (10 per cent) or more, but not less than two, of the total number of equipments furnished under the contract, such part or parts, whether supplied in the equipment or as spares, shall be conclusively presumed to be of defective design, and as a condition of contract subject to one hundred per cent (100%) replacement of all similar units supplied on subject contract by suitable redesigned replacements. Failure due to poor workmanship while not necessarily indicating poor design, will be considered in the same category as failure due to poor design. Redesigned replacements which will assure proper operation of the equipment shall be supplied promptly, transportation paid, to the Naval activities using such equipment, upon receipt of proper notice and without cost to the Government. All defective parts originally furnished under contract shall be held subject to rejection and return to the contractor.

THIS PERIOD OF TWO YEARS AND THE SERVICE PERIOD OF ONE YEAR SHALL NOT INCLUDE ANY PORTION OF THE TIME THAT THE EQUIPMENT FAILS TO GIVE SATISFACTORY PERFORMANCE DUE TO DEFECTIVE ITEMS AND THE NECESSITY FOR REPLACEMENT THEREOF, AND PROVIDED FURTHER, THAT ANY REPLACEMENT PART SHALL BE GUARANTEED TO GIVE ONE YEAR OF SATISFACTORY SERVICE.

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## REPORT OF FAILURE

Report of failure of any part of this equipment, during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 31 (mimeographed form) of the Manual of Engineering Instructions, or Bureau of Ships Radio and Sound Bulletin Number 7, dated July 1, 1942, or superseding instructions.

Contract: NXss-21827 Date of Contract: 14 January, 1943

Serial Number of Equipment _____

Date of Acceptance by the Navy _____

Date of Delivery to Contract Destination _____

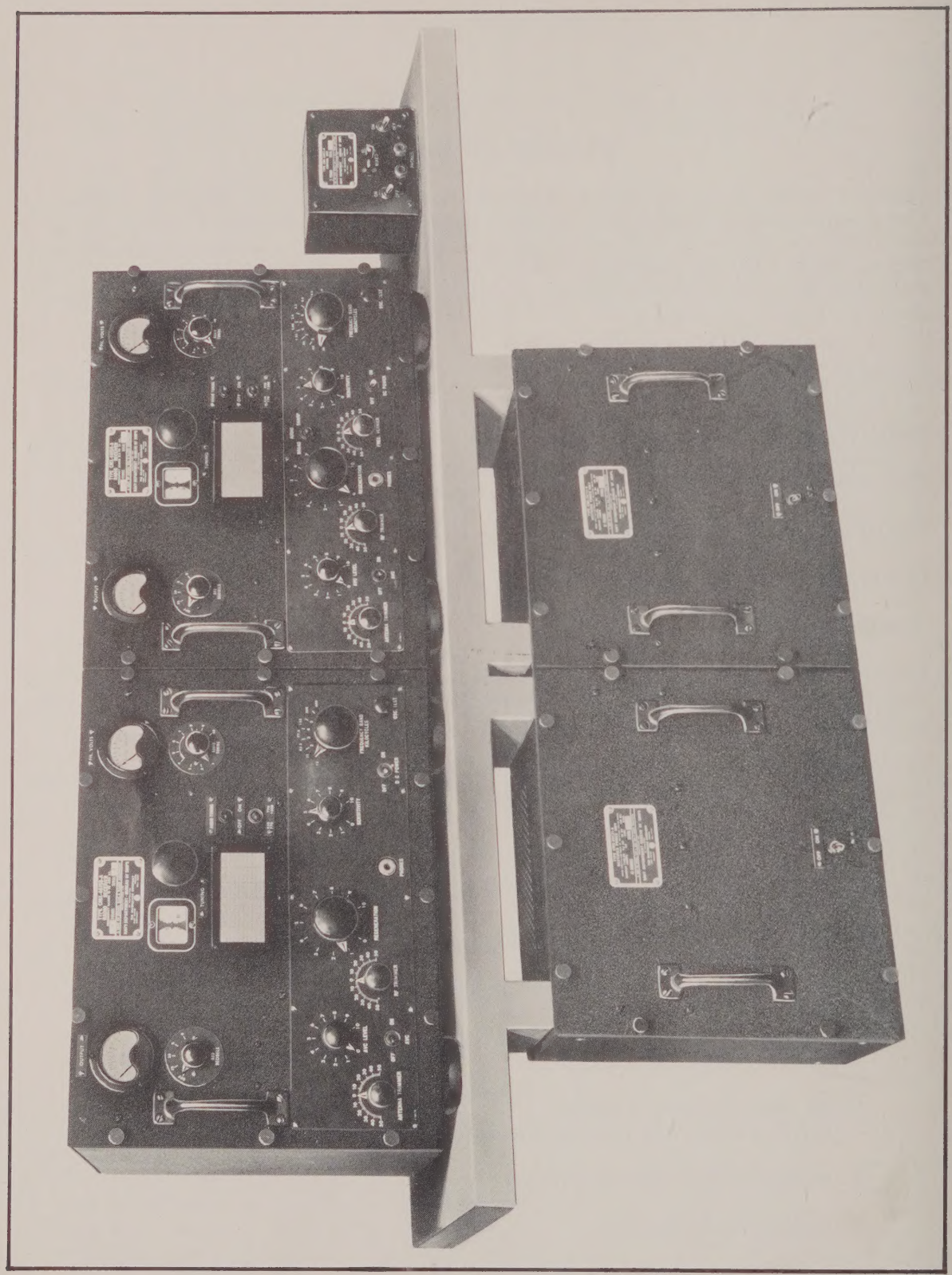
Date of Completion of Installation _____

Date Placed in Service _____

Blank spaces in this book shall be filled in at time of installation. Operating personnel shall also mark the "date placed in service" on the date plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

All requests or requisitions for replacement material should include complete descriptive data covering the part desired, in the following form:

1. Name of part desired.
2. Navy Type number (if assigned) including prefix and suffix as applicable.
3. Model designation (including suffix) of equipment in which used.
4. Navy Type designation (including prefix and suffix where applicable) of major unit in which part is used.
5. Symbol designation of part.
6. (a) Navy Drawing Number.
   (b) Manufacturer's Drawing Number.
7. Rating or other descriptive data.
8. Commercial designation.



*Frontispiece—Model RAK Equipment mounted with a Model RAL Equipment*

# RESTRICTED

This instruction book is furnished for the information of commissioned, warranted, enlisted and civilian personnel of the Navy whose duties involve design, instruction, operation and installation of radio and sound equipment. The word "RESTRICTED" as applied to this instruction book, signifies that this instruction book is to be read only by the above personnel, and that the contents of it should not be made known to persons not connected with the Navy.

## I
## INTRODUCTION

1.1 THESE INSTRUCTIONS SHOULD BE READ AND STUDIED WITH GREAT CARE BEFORE THE INSTALLATION OR OPERATION OF THIS EQUIPMENT IS ATTEMPTED IN ORDER THAT OPTIMUM PERFORMANCE MAY BE OBTAINED.

1.2 These instructions cover the installation, operation, and servicing of the Model RAK-8 Radio Receiving Equipment. This receiving equipment is designed for a-c operation, being equipped with a power unit for supplying all operating voltages required from an a-c source of 110, 115, or 120 volts, 60 cycles, 1 phase.

1.3 This equipment covers the frequency range of 15-600 kilocycles and is designed for optimum performance for the reception of pure, modulated or interrupted CW or damped radio telegraph signals. Voice-modulated reception is not recommended due to the r-f and a-f selectivity provided in these receivers. The output circuit is designed for use with one pair of 600-ohm phones.

1.4 The RAK Series equipment is designed for independent operation but is so designed with respect to size, shape and mechanical arrangement as to permit installation adjacent to an RAL Series equipment, forming a complete two-channel equipment suitable for guarding two frequencies simultaneously by one operator. A separate control unit, Type CMX-23073-A, may be used for this installation to provide flexibility of operation. This unit is described in a subsequent section of this instruction book.

## II
## EQUIPMENT

2.1 Each equipment consists of the following major component units.

(a) Receiver Unit, Type CMX-46155-A.
(b) Power Unit, Type CMX-20131-A.

The Control Unit, Type CMX-23073-A, which is employed when a Model RAK is combined with a Model RAL, is shipped together with the latter equipment only. Both a-c supply cables (W-301) also are furnished only with the Model RAL Equipment.

2.2 In addition to the major units, each complete equipment includes the following items:

(a) Spare parts box, containing spares for major units.
(b) Cables, as follows:

| *Item* | *Quan.* | *Description* | *Dwg. No.* |
|---|---|---|---|
| W-101 | 1 | Cable, output, 2-conductor, shielded | B460246 |
| W-102 | 1 | Cable, output of filter to receiver | B460247 |
| W-201 | 1 | Cable, power, 4-conductor, shielded | C460245 |

(c) Shock absorbers, as follows:

| *Item* | *Quan.* | *Description* | *Dwg. No.* |
|---|---|---|---|
| SA-101 A | 4 | Shock absorber, upper portion, 1⅛" thick | A102064G1 |
| SA-101 B | 4 | Shock absorber, lower portion, ½" thick | A102064G2 |

(d) Miscellaneous mounting hardware, as follows:

| *Item* | *Quan.* | *Description* | *Dwg. No.* |
|---|---|---|---|
| H-101 | 4 | Bolt, ½"-13, 3½" long, hex. head | A102067 |
| H-102 | 4 | Washer, flat, 2" O.D., 9/16" I.D., 0.1285" thick | A101831G39 |
| H-103 | 8 | Nut, ½"-13, hexagonal | A105141G5 |
| *H-104 | 3 | Cap screw, 5/16"-18, ¾" long, hex. head | A105402G3 |
| *H-105 | 6 | Washer, flat, ⅞" O.D., 11/32" I.D., 0.064" thick | A101831G27 |
| *H-106 | 3 | Spacer, 11/16" O.D., 0.327" I.D., 0.125" thick | A101835G24 |
| *H-107 | 3 | Lockwasher, 5/16", split type | A105135G8 |
| *H-108 | 3 | Nut, 5/16"-18, hexagonal | A105145G12 |
| †H-201 | 4 | Cap screw, ¼"-20, ¾" long, hex. head | A105408G3 |
| †H-202 | 8 | Washer, flat, 11/16" O.D., 0.260" I.D., 0.051" thick | A101831G23 |
| †H-203 | 4 | Spacer, 11/16" O.D., 0.265" I.D., 0.125" thick | A101835G23 |
| †H-204 | 4 | Lockwasher, ¼", split type | A105135G7 |
| †H-205 | 4 | Nut, ¼"-20, hexagonal | A105120G17 |

* Parts for interlocking receiver units of Models RAK and RAL.

† Parts for interlocking power units of Models RAK and RAL.

## III

## TUBE COMPLEMENT

3.1 The following Navy standard vacuum tubes are required for each equipment:

4—Type -6D6 RF Amplifiers, Detector and Audio.

2—Type -41 Output and AVC.

1—Type -5Z3 Rectifier.

1—Type -874 Voltage Regulator.

1—Type -876 Current Regulator.

## IV

## POWER REQUIREMENTS

4.1 Normal Operation.

4.1–1 The receiver is designed to operate from a 110-, 115-, or 120-volt, 60-cycle, single-phase, a-c supply, with a fast and slow voltage variation not exceeding ±10%.

4.1–2 The total power consumption of the RAK Series equipment is approximately 60 watts when the current-regulator tube in the power unit is not used, and approximately 200 watts when the current-regulator tube is in the circuit (see paragraphs 9.5–6 and 10.2–3).

4.2 Emergency Battery Operation.

4.2–1 The filament supply may be obtained from a 6-volt storage battery. The current drain is approximately 2 amperes.

4.2–2 A single "B" potential of 180 volts is required. This supply may be either a storage battery or a suitable combination of dry cell batteries. The current drain is approximately 45 milliamperes. No "C" batteries are required.

# V
# ANTENNA REQUIREMENTS

5.1 This equipment is primarily designed for operation with a separate antenna not used for other equipmnet. However, the Model RAK Equipment may be operated on an antenna common with the Model RAL Equipment as an emergency measure. The antennas should be spaced at least 6 feet from any parallel stay, mast or stack, must be well insulated and erected as high as possible. The length of the antenna should be approximately 50 feet in the clear. A ½-megohm static-drain resistor should be permanently installed between each antenna and ground. The antenna lead connecting to each receiver should be flexible insulated cable and terminate in a Navy Type -49121 concentric plug. This plug connects to the Navy Type -49120 concentric jack, located on the rear of the receiver.

If a particularly long antenna installation is desirable or if the lead-in arrangement obtains particularly high capacity to ground, the shorting link located on a terminal board adjacent to the antenna concentric jack J-102 must be opened. This link is accessible only after the receiver chassis has been removed from its cabinet. To remove the receiver chassis, loosen the thumb screws holding the front panel to the cabinet; withdraw the chassis by pulling on the two panel handles. After the link has been opened, be sure to tighten the terminal screw after placing the link against the insulation board so that the link will not short due to vibration.

It is preferable to use the receiver with the link shorted; necessity for opening the link will be evidenced by inability to obtain resonance with the antenna trimmer, particularly on Bands "1" and "2".

**NOTE:** NO OTHER RECEIVER SHOULD BE USED ON THE SAME ANTENNA WITH THIS EQUIPMENT EXCEPT AS AN EMERGENCY MEASURE.

5.2 When it is necessary to operate this equipment from an antenna common to a RAL Equipment as an emergency measure, the shorting link on the terminal board adjacent the antenna concentric jack, must be OPEN.

5.3 The ground connection should be made to some grounded metal portion of the ship, as specified under "Wiring" (paragraph 6.4-2) and should be soldered, if practicable, to prevent variable, or high-resistance contact due to corrosion.

5.4 The use of bonded stays is equally as desirable with this equipment as with other Navy receivers to eliminate noises arising from variable contacts or grounds on such stays.

# VI
# INSTALLATION

6.1 Receiver Unit Mounting.

6.1–1 It is essential that the receiver unit be secured to its table by means of the rubber shock absorber mounting provided. Figure 14 illustrates in detail the manner in which these receivers are to be installed, including dimensions for drilling the operating table or desk. In planning this installation, care should be exercised to provide for a clearance of at least three inches or more from the back of the receivers to the bulkhead or nearest obstruction in order to permit movement of cables when withdrawing the chassis from the cabinets for servicing. Should these receivers be operated in pairs, the cabinets must be bolted together and in place after the chassis have been removed. To remove the receiver chassis, it is necessary to loosen the thumb screws holding the front panel to the cabinet. (These thumb screws do not come clear of the panel.) If the equipment has been previously set up, it will be necessary to disconnect the cables to the auxiliary equipments. Using the handles provided on the front panel, remove the chassis completely from the cabinet. CARE SHOULD BE TAKEN TO SET THE CHASSIS ON A FLAT SURFACE FREE FROM ANY OBJECTS WHICH MIGHT DAMAGE THE SHIELDING.

6.1–2 The several cables of this equipment should be fed through the holes in the rear of the cabinet and connected as shown in Figure 15. The large shielded cable (W-201) connects the receiver unit to the power unit. A smaller shielded cable (W-101) connects the control units (its use being optional) to the receiver unit, while another cable (W-301) connects the power unit to the control unit. Should only one receiver and no control unit be used, refer to Figure 15 for the power cord connections.

6.1–3 Using a one-inch drill, pierce the top of the desk in accordance with the dimensions given in Figure 14. Place one rubber shock absorber (SA-101A) in each of these holes. Locate the cabinets in their proper positions on the desk top so that their mounting

holes coincide with the holes in the shock absorbers and insert the mounting bolts. Next, place the bottom shock-absorber (SA-101B), a metal washer, nut and lock nut on each bolt as shown in Figure 14, but do not tighten the nuts. In case two receivers are used together, bolt the adjacent sides by means of the short bolts provided. Place these bolts in the holes inside the cabinets. Place washers under the heads and washers, lockwashers and nuts on the opposite end of the bolt. Before tightening these nuts, carefully align the cabinets both horizontally and vertically. When the cabinets have been secured to each other, tighten the mounting bolts just sufficient to slightly compress the rubber shock absorbers.

6.2 Power Unit Mounting.

6.2–1 The power unit cable should be mounted beneath the operating table by means of four bolts, washers and lockwashers (not supplied). It should be spaced a minimum of 1½ inches from the bottom of the table by cleats or other means so as to allow ample ventilation. The details of the installation and the drilling plan for these mounting bolts are also shown in Figure 14. Remove the power unit from the cabinet by first loosening the panel thumb screws and then withdraw by means of the two handles provided on the panel. If the equipment has been previously set up, it will be necessary to remove the cable connections from the terminal board at the right side of the power unit, just in back of the panel. For further details, see Figure 15.

6.3 Control Unit Mounting.

6.3–1 The control unit cabinet, when used, should be mounted at any convenient place on the operating table by means of two bolts through two holes provided in the bottom of the cabinet and fastened securely with lockwashers and nuts. To remove the chassis, loosen the four screws in the panel. Use of the control unit is optional with this equipment, its operation being described in paragraph 9.6.

6.4 Wiring.

6.4–1 The wiring between units is shown in Figure 15. At installation, the supply voltage should be measured or otherwise ascertained and the primary taps of the power transformer (T-201) shifted if necessary to comply with the nominal line rating. These taps are connected at the factory for 115 volts as indicated by the marking "115" adjacent to the terminals to which the *red* wires from toggle switch S-202 is connected (see Figures 1, 4 and 20). If the supply voltage is nearer 110 or 120 volts than 115 volts, shift these *red* wires to one of the two other pairs of terminals (marked "110" and "120," respectively) as required. To eliminate as much a-c hum and other electrical interference as possible, the 110-, 115-, or 120-volt, a-c supply should be connected to the power unit by a shielded twisted pair of wires (No. 14 or larger), or run in grounded conduit as far as the bulkhead adjacent to the power unit and terminated in a junction box. In no case should transformers or other a-c equipment be located in close proximity to the receiver.

6.4–2 Grounds should be made to some grounded metal portion of the ship. Contact surfaces must be scraped free from paint. Pipes should be avoided since they are a questionable ground aboard ship.

**NOTE:** THE IMPORTANCE OF SECURING A GOOD GROUND WITH A SHORT, DIRECT, LOW RESISTANCE GROUND LEAD CANNOT BE OVEREMPHASIZED. THIS IS OF PARTICULAR IMPORTANCE IN MINIMIZING PICKUP AND INTERFERENCE FROM NEARBY TRANSMITTERS.

6.4–3 Sufficient slack should be left in sections of cables external to cabinets to permit withdrawal of chassis from cabinets for service checking with voltages applied.

6.4–4 Emergency Battery Operation.

Referring to Figure 15, Cable W-101 is used to connect the receiver output to the output line or to the control unit if used. In an emergency, should it be desired to operate the receiver on batteries, Cable W-201 connects the receiver to a battery terminal block (not supplied). The battery terminal block must be arranged to supply screw terminals for connection to the spade terminals of Cable W-201. Wiring from the batteries to the terminal block should be run in grounded conduit and the filament wiring should be of sufficient size to offer negligible voltage drop (each receiver draws approximately 2 amperes filament current).

# VII
# TUBE LOCATIONS

7.1 Power Unit CMX-20131-A.

7.1–1 The tube locations are shown in Figures 1 and 15.

(a) Type -5Z3 rectifier, left front of chassis.

(b) Type -874 voltage regulator, right front of chassis.

(c) Type -876 current regulator, center rear (not used if line regulation is within ±10%; see paragraph 9.5–6).

7.2 Receiver Unit CMX-46155-A.

7.2–1 The tube locations are shown in Figures 2 and 15.

(a) Type -6D6 first r-f, rear left of chassis.

(b) Type -6D6 2nd r-f, rear center of chassis.

(c) Type -6D6 detector, rear right of chassis.

(d) Type -41 output limiter, left front of chassis.

(e) Type -41 audio output, center front of chassis.

(f) Type -6D6 first audio, right front of chassis.

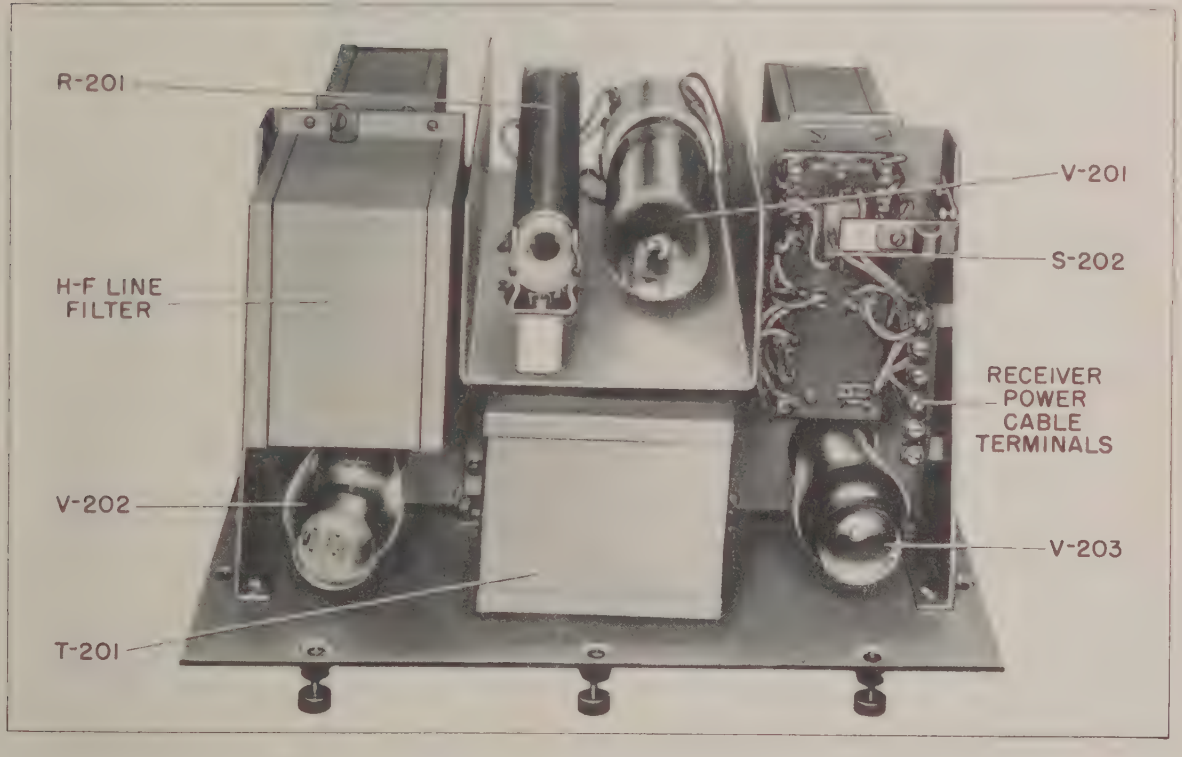



*Figure 1 — Power Unit CMX-20131-A (Top View of Chassis)*

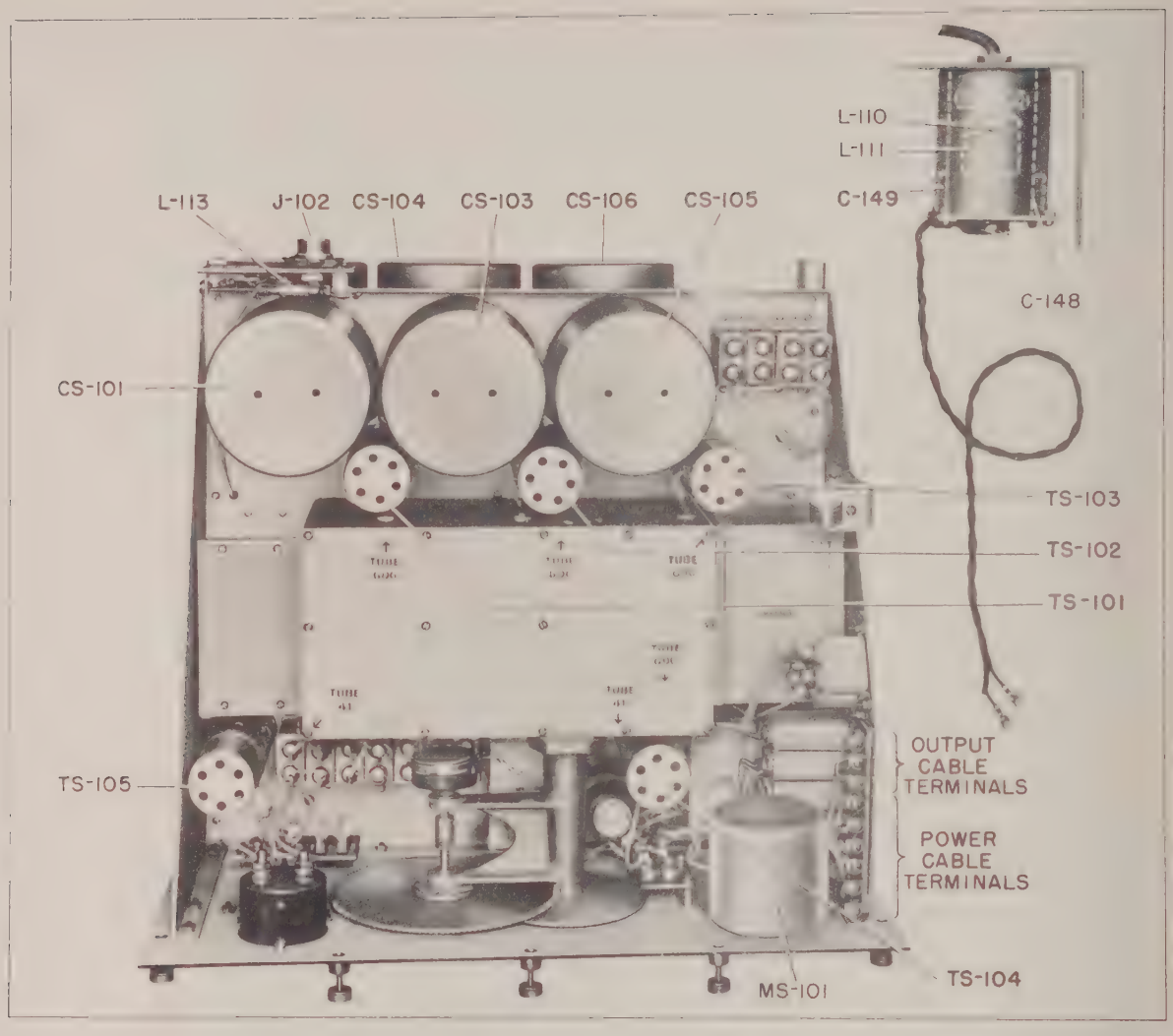



*Figure 2—Receiver Unit CMX-46155-A (Top View of Chassis)*

## VIII
## CONSTRUCTION

8.1 Dimensions and Weights.

8.1–1 Figure 14 illustrates the overall dimensions of the RAK and RAL equipments as arranged for installation. The weights of the units are as follows:

(a) Type CMX-46155-A Receiver Unit ..... 74 lbs.
(b) Type CMX-20131-A Power Unit ..... 41 lbs.
(c) Type CMX-23073-A Control Unit ..... 2 lbs.

8.2 Receiver Unit CMX-46155-A.

8.2–1 As indicated in Figure 14, the receiver unit is designed for table mounting. The cabinet may be permanently fastened to the table and the chassis is removable for access

to tubes, for servicing and for cable connections. All components are mounted on the chassis or panel forming a single assembly (see Figures 2, 3, and 6). Audio and AVC components are mounted directly behind the panel with filter and audio tuning units at the right, the first audio and output tubes in the center, and the AVC circuit at the left. Audio wiring, resistors, etc. are located beneath the chassis. The tuning capacitor assembly is located just back of the audio components. The top plate on the capacitor assembly is removable for inspection. At the rear of the chassis are located the r-f and detector tubes and the r-f coils, which are protected and shielded by screw cans. The power terminals are located at the right of the chassis and the antenna and ground terminals at the left. The band switch, r-f components and wiring are located beneath the chassis in a fabricated shield box. The large cover plate on the bottom of the receiver is removable for inspection and access to these parts.

8.3 Power Unit CMX-20131-A.

8.3–1 The power unit is designed for mounting underneath a table (see Figure 14). The cabinet may be permanently mounted, the chassis being removable for access to tubes, for servicing, and for cable connections. All components are mounted on the chassis or panel forming a single assembly (see Figures 1, 4, and 7). On top of the chassis from left to right are located the rectifier tube, h-f line filter shield, power transformer, voltage regulator tube, resistor board, and power terminals. The line filter shield at the left rear is removable for access to the line input terminals and fuses. In the center at the rear is located the current-regulator tube. Beneath the chassis from left to right are located the l-f line filter, ripple filter reactors, and ripple filter capacitor pack.

8.4 Control Unit CMX-23073-A.

8.4–1 The control unit contains output jacks, mixer switch, and power switches mounted on the panel. (See Figure 5.) Fuses and terminal boards are mounted on a bracket secured to the panel. The case may be permanently mounted to any flat surface (see Figure 14).

## IX

## CIRCUIT DESCRIPTION

9.1 The schematic diagram of the receiver unit (Figure 16) shows the arrangement of the radio- and audio-frequency circuits.

9.2 The antenna is capacitively coupled to the first tuned circuit, the coupling being designed to give optimum energy transfer in order to secure the best possible signal-to-noise ratio. When a particularly long or high-capacity antenna is used or when it is necessary to operate this receiver on the same antenna with an RAL equipment, looser coupling is desirable. The antenna input circuit, therefore, has been so arranged that an additional capacitor is placed in series with the usual antenna coupling capacitor when the link across capacitor C-101 is "opened." See Antenna Requirements," Section V.

9.3 The requisite sensitivity and selectivity at the signal frequency is obtained by the use of two r-f stages and a regenerative detector stage. Uni-control is accomplished by means of a 3-gang variable capacitor, tuning the two r-f stages and the detector.

9.3–1 The frequency range of 15 to 600 kilocycles is covered in six bands by means of coil switching as shown on the schematic diagram. The necessary inductances are wound on two sets of coil bodies. Unused portions of the coils are grounded or short circuited where they would otherwise cause undesirable losses to be placed in the tuned circuit.

9.3–2 Two Type -6D6 tubes are used as r-f amplifiers and a third Type -6D6 is used as a regenerative detector.

9.3–3 In order to hold the sensitivity of the receiver essentially constant over the wide frequency range employed, and to improve selectivity, the plate circuits of the two r-f amplifier stages are tapped down on their tuning impedances. In addition, a rheostat connected to the main tuning dial is arranged to increase the bias on the r-f tubes as the tuning capacitor is rotated toward the high-frequency end of the band. This rheostat automatically obtains uniform sensitivity over a given band as the tuning dial is rotated.

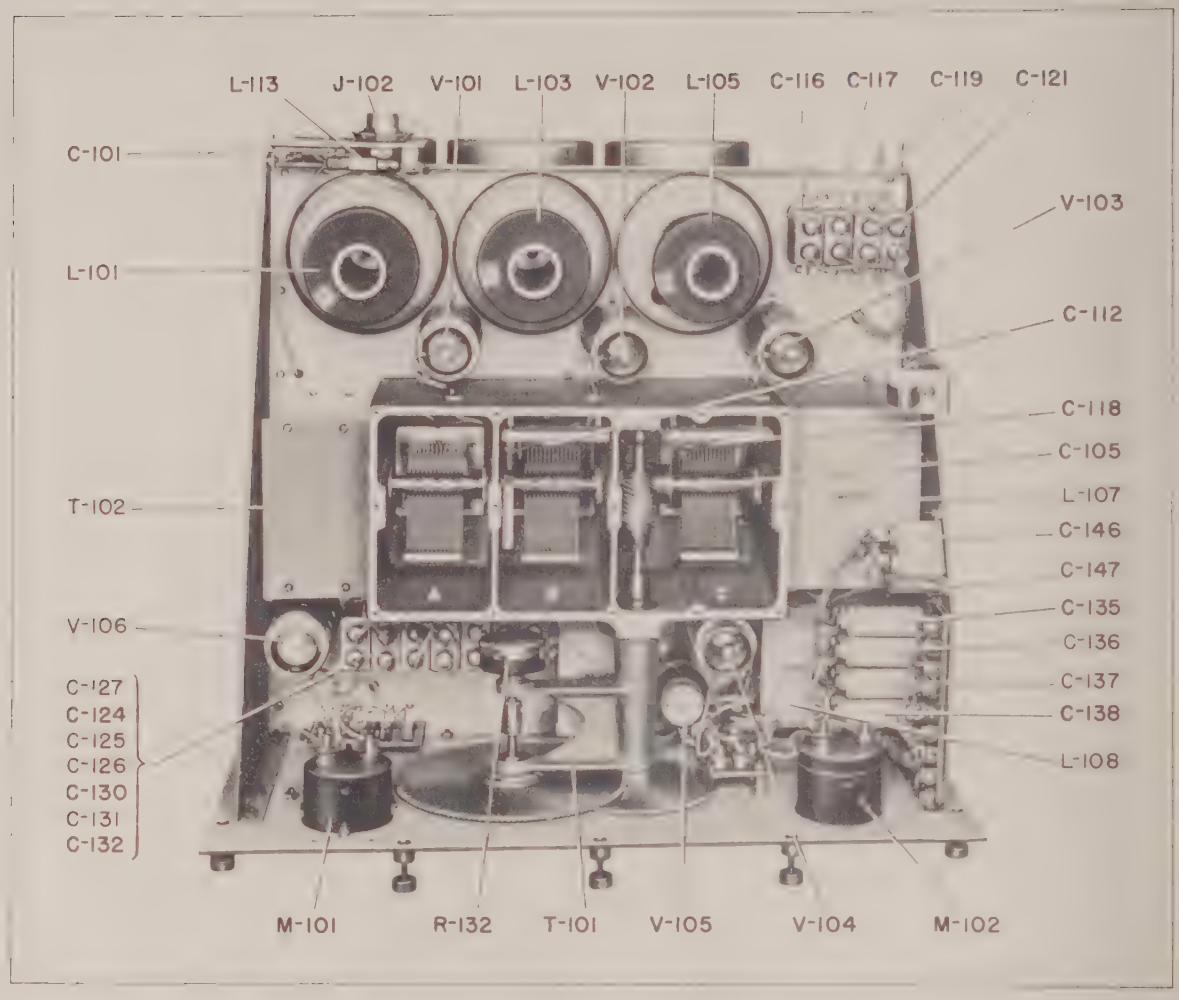



*Figure 3—Receiver Unit CMX-46155-A (Top View of Chassis—Covers Removed)*

9.3–4 CW reception and improved sensitivity and selectivity is accomplished by the use of a specially-designed autodyne detector circuit. This detector employs the familiar electron coupling with the resultantminimizing of reaction in all circuit switching in the audio system. A very high degree of frequency stability is inherent in this type of circuit. The particular design obviates the necessity for frequent adjustment of the "Regeneration" control and renders it possible to obtain the desired performance characteristics of this detector without critical adjustment of the controls.

9.3–5 Sensitivity is controlled by varying the cathode potential of the two r-f stages with respect to the grid potential of those stages.

9.3–6 In order to obtain optimum performance of the equipment under all service conditions, small trimmer capacitors adjustable from the front panel are provided on the first and second r-f tuned circuits.

9.3–7 The receiver unit is completely shielded both internally and externally to minimize cross talk between receivers. All power leads are filtered with resistance-capacity filters. Inter-stage shielding is provided to increase selectivity and stability and to minimize reaction.

9.4 The audio system includes two stages of amplification and an output limiter. Filters are provided which increase the effective CW selectivity and improve the signal-to-noise ratio.

9.4–1 A low-pass filter immediately follows the detector circuit. This filter provides attenuation of less than 6 db at 1200 cycles and more than 40 db at frequencies above 1600 cycles.

9.4–2 A variable audio-frequency attenuator which may be switched in or out of the circuit by means of a panel control follows the low-pass filter. This attenuator operates over the range of 450-1300 cycles (this indicates "acceptance" of the frequency to which the attenuator is adjusted and "attenuation" of other frequencies). A choice of resonant frequency is afforded by means of a 10-position switch and a 2-position range switch. Schematically, this attenuator is a tuned circuit inserted in parallel with the grid of the first audio stage.

9.4–3 A Type -6D6 tube is used in the first audio-frequency amplifier stage.

9.4–4 The first audio stage is resistance coupled to a Type -41 output stage which, in turn, is transformer coupled for use with an output impedance of approximately 600 ohms. The output transformer employs an electrostatic shield and a center-tapped output winding to obtain a balanced output circuit.

9.4–5 A switch operated from the front panel permits an audio limiter tube (Type -41) to operate on the plate circuit of the output stage. The switch connects the output limiter transformer in parallel with the primary of the output transformer. The output limiter transformer has a high voltage step-up ratio and feeds the Type -41 tube which is connected as a biased rectifier. When the receiver output reaches a certain level (determined by an adjustable bias on the rectifier), the rectifier starts drawing grid current and the rectifier grid resistance decreases. This resistance reflected through the high-ratio transformer results in a low effective impedance load in the receiver output stage plate circuit and thus limits the output voltage to a certain value. Since the AVC is operated by audio output only, it is not affected by strong CW signals which do not produce an audio beat note. The output level to which the signal is limited may be varied by adjustment of the rectifier bias from the control on the front panel.

**NOTE:** THIS CONTROL IS NOT INTENDED FOR USE ON VOICE-MODULATED SIGNALS SINCE IT INTRODUCES HARMONICS OF THE AUDIBLE NOTE AND PRODUCES PROHIBITIVE DISTORTION.

9.4–6 A rectifier type DB output meter and range switch are provided on the front panel. This meter indicates the audio level delivered to the headphones.

9.4–7 A voltmeter which indicates filament voltage is provided on the front panel.

9.4–8 Normally, the a-c power is controlled either from the control unit or the power unit. In addition, a d-c power "On-Off" switch is provided on the receiver panel for use only in the event the receiver in an emergency is operated on batteries. *If this switch is opened when the receiver is normally operated on a.c., the load is removed from the power unit and overloading and damage of certain of its parts may result.* For this reason, shorting links are provided behind the panel (see Figure 6) which permanently close this switch circuit. If it is desired in an emergency to operate the receiver on batteries, these links should be opened.

9.5 Power Unit CMX-20131-A, shown schematically in Figure 17, has been very carefully designed in order to maintain an accurate calibration of the receiver and a high degree of frequency stability. Several special features are embodied in the design in order to afford very constant voltage on the screen grid of the autodyne detector which is the element primarily affected by power supply voltage variation. The power supply circuit consists essentially of r-f filters in the a-c supply line, a Type -876 current regulator (used when required), an electrostatically-shielded power transformer, a Type -5Z3 rectifier tube, a specially developed two-stage filter, a Type -874 voltage regulator, and a protective bleeder.

9.5–1 The r-f filter unit has been very carefully designed substantially to eliminate cross talk between several equipments operating from one power supply system and to reduce interference which may be present on the a-c line.

9.5–2 The power transformer has been designed for operation from a 110-, 115-, or 120-volt, 60-cycle supply, and taps are provided on the primary to accommodate any of these nominal voltages. The total power consumption of this transformer under normal operation (with current Regulator Tube V-201 removed from socket) is approximately 60 watts. Filament supply is obtained from a center-tapped winding on this transformer.

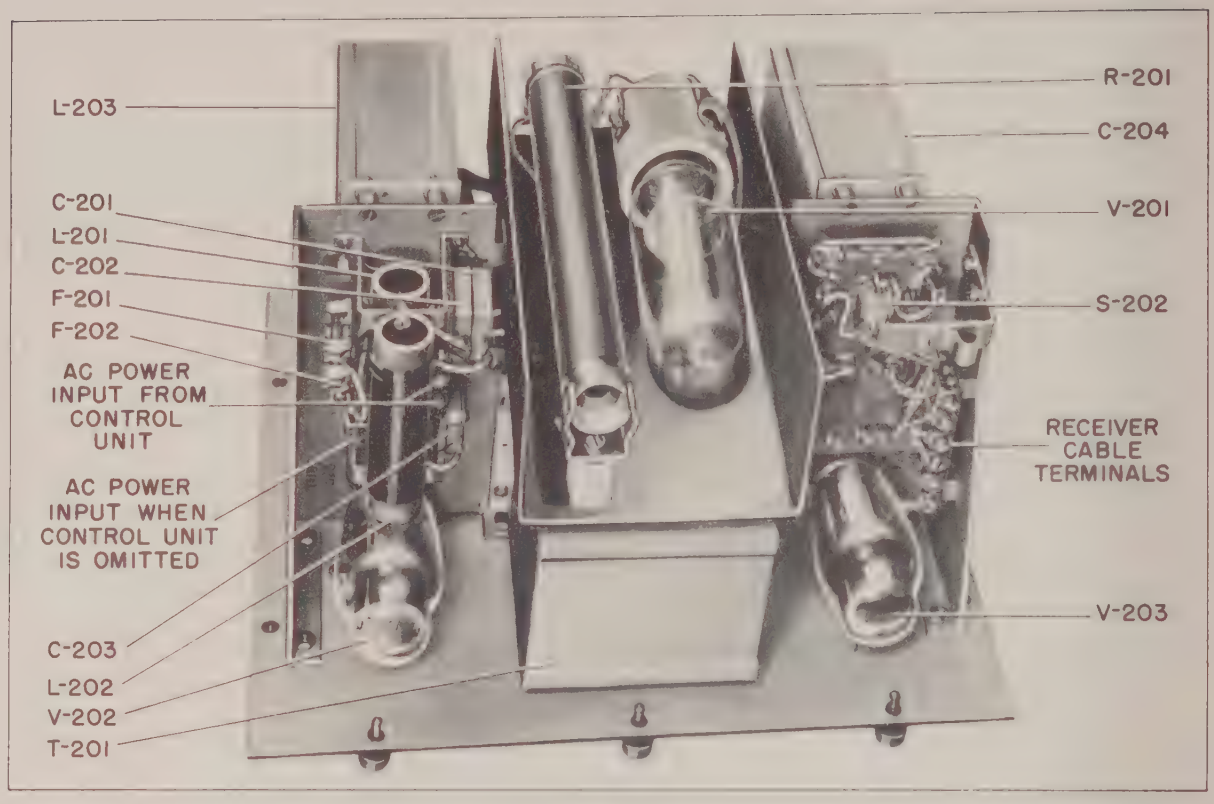



*Figure 4 — Power Unit CMX-20131-A (Top View of Chassis — Covers Removed)*

9.5–3 The Type -5Z3 rectifier tube and bleeder provide a plate source of good regulation.

9.5–4 The screen voltage of the autodyne detector is stabilized by means of a Type -874 regulator tube.

9.5–5 A power switch is provided on the front panel of this unit for turning the equipment on and off when no control unit is employed.

9.5–6 In order to make this power unit interchangeable with the one used in the RAL Series equipment, a socket is provided for a Type -876 current-regulator tube. Since this equipment operates at relatively low frequencies, the additional freedom from effect of line voltage variation obtained from the current-regulator tube is not needed if the line regulation is within ±10 percent. In the interest of conserving primary supply current, its use with this equipment is not recommended under normal circumstances. A switch, therefore, is provided inside the unit (see Figures 1 and 4) which accomplishes the changes in circuit necessary for operation without this tube. This switch disconnects the current-regulator tube and switches the power transformer primary for operation directly connected to the line filter. (See paragraph 10.2–3.)

9.5–7 Referring to Figure 15, it will be observed that four terminals are provided for connecting the 110-, 115-, or 120-volt, 60-cycle supply to the power unit. When this equipment is used with the control unit, the power connection from the control unit to the power unit is made to the two right-hand terminals. When no control unit is employed, the connection is made to the left-hand terminals. Connecting to the two right-hand terminals removes the power switch on the panel from the circuit. (See Figure 4.)

9.6 Control Unit CMX-23073-A (see Figure 5) is shown schematically in Figure 18. The use of this control unit makes possible the guarding of two channels simultaneously. The output of each receiver feeds into the control unit where a 3-position switch is provided which makes available, in the two headphone jacks, signals from either or both of the receivers. Two power switches also are provided on the control unit panel for controlling the power to each receiver independently. The a-c power supply feeds into the control unit and each side of the line is fused. The two supply cables connect to suitable terminals on the power units which terminals are arranged to omit from the circuit the switch and the fuses in the power unit.

9.7 In order to reduce interference from neighboring transmitters several filter circuits have been introduced as follows:

9.7–1 For reduction of U.H.F. interference, a choke coil (L113) is connected between the antenna terminal and a terminating ceramic spacer. Normally, this choke coil comes shunted by a bus; this bus should be cut if interference is reduced by temporarily disconnecting the antenna.

9.7–2 A filter assembly connected to the output jack J101 and consisting of coils L112A and L112B and by-pass capacitors C150 and C151 eliminates signal pick-up on the phone leads. The shield around the phone jack prevents direct radiation from the jack itself. See Figure 6.

9.7–3 An output cable filter assembly consisting of series coils L110 and L111 and by-pass capacitors C148 and C149 prevents signal pick-up on the phone leads and output cable connecting the control box to the receiver. It is mounted in a shielded can which prevents any direct radiation when assembled inside the receiver cabinet. This filter unit is mounted in the cabinet and is illustrated in Figure 2.

9.7–4 A grounding wiper is provided for the main tuning shaft to reduce radiation inside of the receiver.

9.7–5 Grounding clamps are provided on the Receiver and Power Supply Unit cases for grounding the braided shielding of the output and power supply cables. (W101 and W201.)

## X
## OPERATION

10.1 Controls of Receiver Unit CMX-46155-A.

10.1–1 The antenna should be connected to the concentric jack marked "Antenna," located at the rear of the cabinet. See "Antenna Requirements," Section V.

10.1–2 "FREQUENCY BAND" Selector Control: This control serves as a means for changing the required inductance for the various radio-frequency bands. The switch pointer should be set on the band number falling between the frequencies which establish the desired frequency range. Frequencies are marked in kilocycles.

10.1–3 "TUNING" Control. The tuning control varies the setting of the three-gang variable tuning capacitor. The scale increases with frequency.

10.1–4 "ANTENNA TRIMMER" Control: This control is a variable trimmer capacitor for the antenna tuning stage (1st R-F grid circuit). In general, it is adjusted once for each band, preferably at the high-frequency end.

10.1–5 "RF TRIMMER" Control: This control is a variable trimmer capacitor for the first r-f tuned grid circuit. In general, it is adjusted once for each band, preferably at the high-frequency end.

10.1–6 "FIL. VOLTS": The filament voltmeter indicates when the power is turned "On" and should read approximately 6 volts when the equipment is operating properly.

10.1–7 "AVC OFF-ON" Switch: This switch when in the "On" position, places the automatic volume control in operation; when in the "Off" position, it disconnects the automatic volume control. The automatic volume control is *not* intended for use on voice-modulated signals.

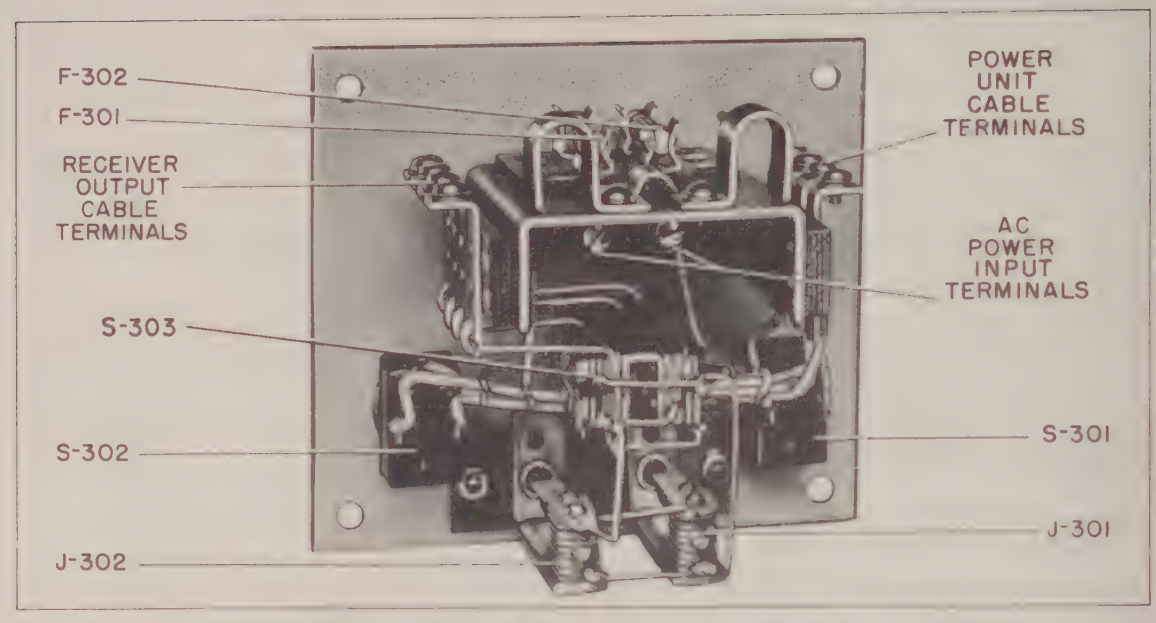



*Figure 5—Control Unit CMX-[illegible]-A (Rear View of Panel)*

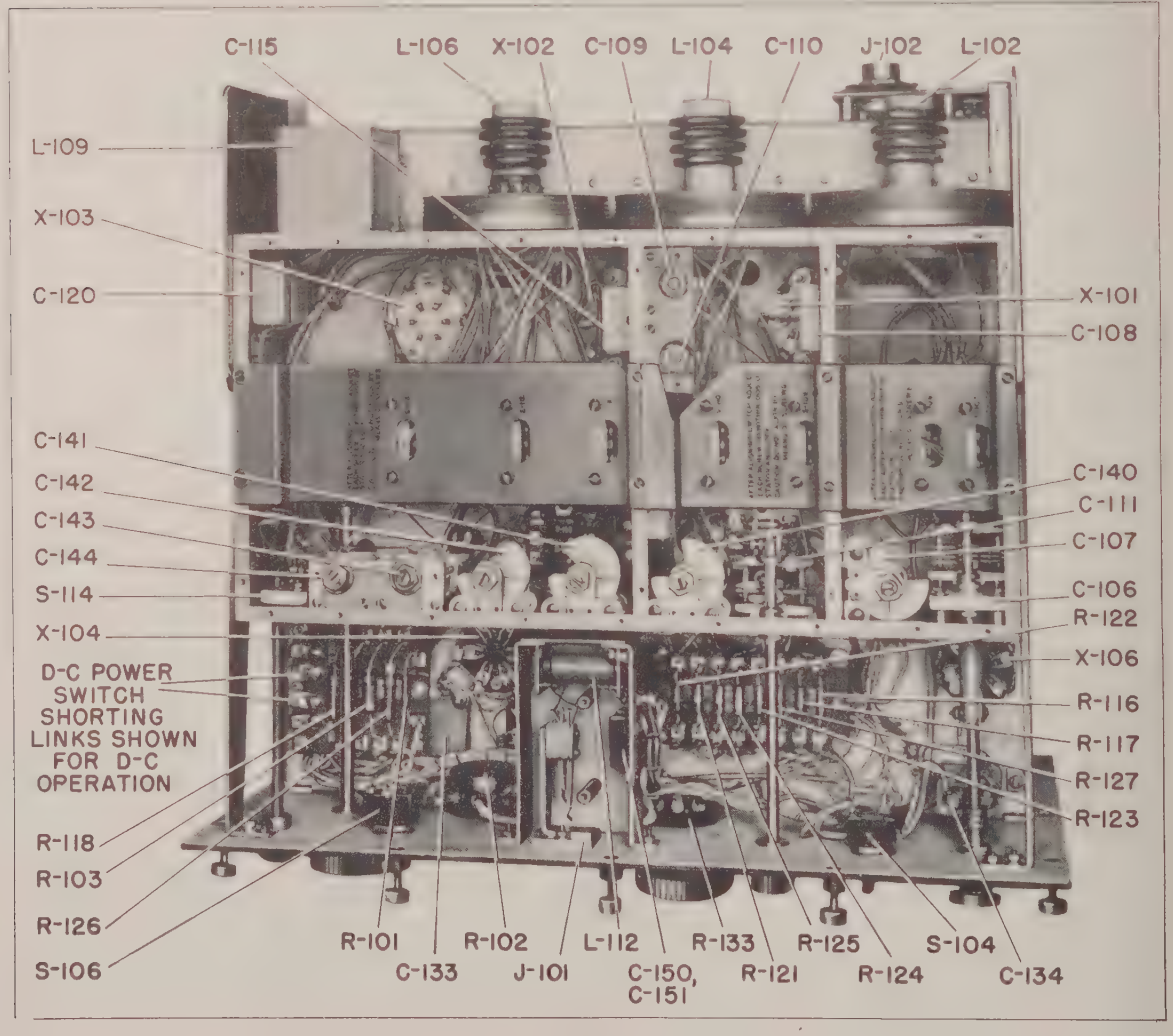



*Figure 6—Receiver Unit CMX-46155-A (Bottom View of Chassis—Covers Removed)*

10.1–8 "AVC LEVEL" Control: This control varies the bias on the AVC tube and thereby sets the volume level when the "AVC Off-On" switch is in the "On" position.

10.1–9 "REGENERATION" Control: This control varies the screen-grid potential of the autodyne detector thus regulating the degree of feedback required for oscillation.

10.1–10 "SENSITIVITY" Control: This control varies the cathode potential of the two r-f tubes with respect to their grid potentials.

10.1–11 "AUDIO TUNING" Control: This 10-position switch selects the proper inductance in the audio-frequency variable attenuator circuit to permit this circuit to pass frequencies in the range of 450 to 770 or 770 to 1300 cycles depending upon the position of the audio tuning range switch (see 10.1–13). The switch positions are numbered to increase with respect to frequency.

10.1–12 Audio Tuning "OFF-ON": This switch places the audio-frequency variable attenuator in or out of the circuit.

10.1–13 Audio Tuning "450-770" or "770-1300" Switch: This switch selects the range of frequency in cycles in which the ten-position "Audio Tuning" control is operable.

10.1–14 "OUTPUT" Meter: This rectifier type a-c meter indicates the audio-frequency output level delivered to the headphones. It is calibrated in decibels above and below zero level, which is 6 milliwatts of audio output.

10.1–15 "ADD DECIBELS" Switch: This range switch is used to read "Add Decibels" (algebraically) in connection with the output meter. Five positions are provided: "Off," "15," "10," "5," and "0" in a clockwise direction.

10.1–16 "OSC. TEST" Button: This push button is connected from the detector cathode to ground. When it is depressed, it stops the detector from oscillating and produces a definite double click in the headphones. In many cases, the detector enters and leaves oscillation so gradually that it is necessary to use this button in order to determine whether or not the detector is oscillating.

10.1–17 "D.C. POWER OFF-ON" Switch: This switch is not used in the normal operation of this equipment and is accordingly wired out of the circuit by short-circuiting links located under the chassis (see Figure 6).

NOTE: HOWEVER, SHOULD OCCASION ARISE, THIS EQUIPMENT MAY BE OPERATED FROM A BATTERY SUPPLY CONSISTING OF SUITABLE FILAMENT AND PLATE BATTERIES. THIS METHOD OF OPERATION WILL REQUIRE OPENING OF SHORT-CIRCUITING LINKS (SEE FIGURES 6 AND 19) AND CONNECTION OF CABLE W-201, AS INDICATED BY THE DOTTED LINES IN FIGURE 15. OPERATION OF THE RECEIVER WILL THEN BE CONTROLLED BY THE "DC POWER" SWITCH ON THE FRONT PANEL.

10.1–18 "PHONES" Jack: This jack provides termination for a pair of low-impedance (600-ohm) headphones.

10.2 Controls of Power Unit CMX-20131-A.

10.2–1 "OFF-ON" Switch: This switch located on the front panel controls all power to the power unit, when not used in conjunction with a control unit.

10.2–2 Reference to Figure 15 shows that when the power unit is used in conjunction with the control unit, connection is made to the right-hand input terminals of the power unit. With this connection, the panel switch and the power unit fuses are disconnected from the circuit.

10.2–3 Current Regulator Switch: This switch is located under a terminal board at the right rear top of the chassis (see Figures 1, 4 and 20) and should be thrown to the "Out" position for this equipment. In this position, the proper primary connections to the transformer are made for operation without current regulation.

10.3 Controls of Control Unit CMX-23073-A.

10.3–1 For operation of Receiver No. 1, place the "On-Off 1" Switch in the "On" position, the "1"-"mixed"-"2" switch in the "1" position and the "On-Off 2" switch in the "Off" position. The headphones should be plugged into one of the phone jacks on the control unit.

10.3–2 For operation of Receiver No. 2, proceed as in 10.3–1 above except that all switches should be thrown to the "2" position.

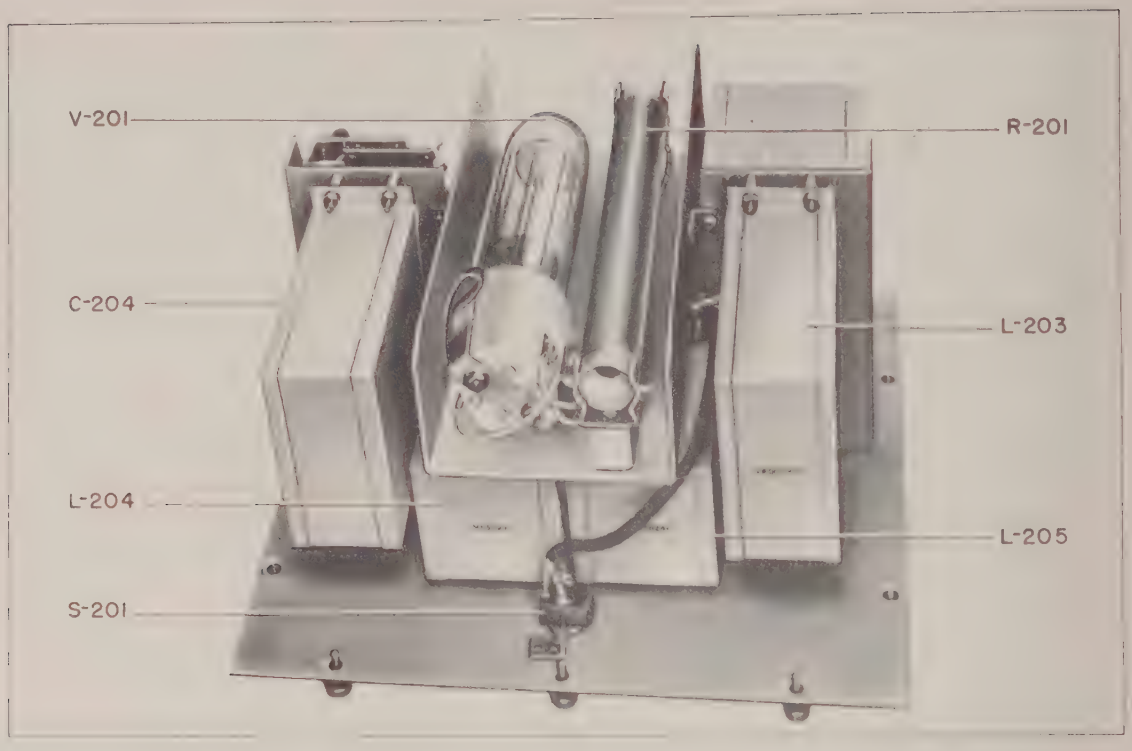



*Figure 7—Power Unit CMX-20131-A (Bottom View of Chassis)*

10.3–3 For simultaneous monitoring of the output from two receivers, both No. 1 and No. 2 "On-Off" switches should be placed in the "On" position and the "1"-"mixed"-"2" switch should be placed in the "mixed" position. The headphones should be plugged into one of the jacks on the control unit. (The phone jacks on the receiver units are not controlled by the "1"-"mixed"-"2" switch.) Two phone jacks are provided to permit simultaneous monitoring or operation by two operators.

10.4 CW Reception.

10.4–1 To place power on the equipment, the proper "Off-On" switch should be thrown to the "On" position. The filament voltmeter should indicate approximately 6 volts. Allow sufficient time for the tube heaters to reach their operating temperature. This time will probably be not less than 30 seconds.

(a) When using a single RAK Series equipment, the "On-Off" switch on the power unit controls the power to the receiver.

(b) When using this equipment in combination with an RAL Series equipment, the proper "Off-On" switch on the control unit controls the power to the desired receiver.

10.4–2 To receive a signal whose frequency is known, throw the Audio Tuning and AVC "Off-On" switches to the "Off" positions.

10.4–3 Set the "Frequency Band" switch to the band number corresponding to the frequency range which includes the frequency of the station desired.

10.4–4 The "Tuning" control should be set to the desired frequency by reference to the calibration chart and the "Sensitivity" control should be advanced until a perceptible noise level is obtained. The "Antenna Trimmer" and the "RF Trimmer" should be adjusted for *maximum* noise output.

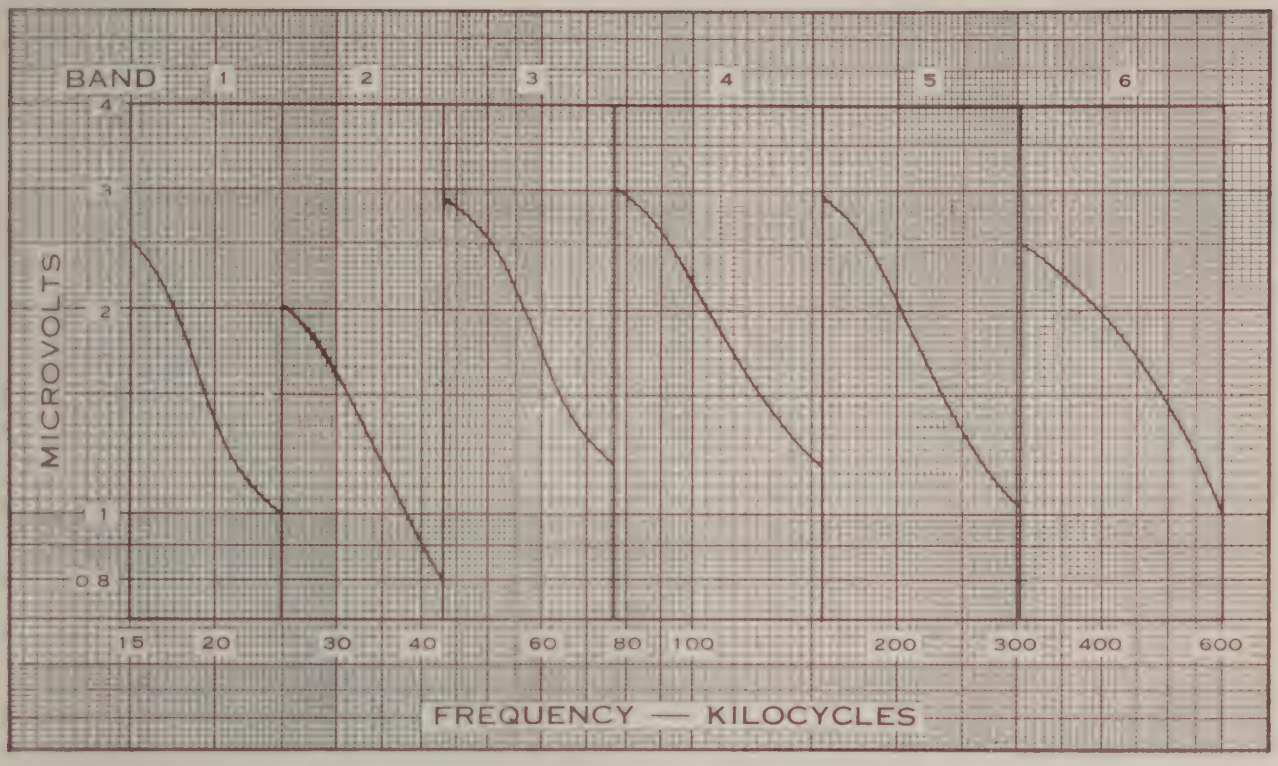



*Figure 8—Sensitivity (microvolts for 6 .05 M.W. Signal/Noise Ratio)*

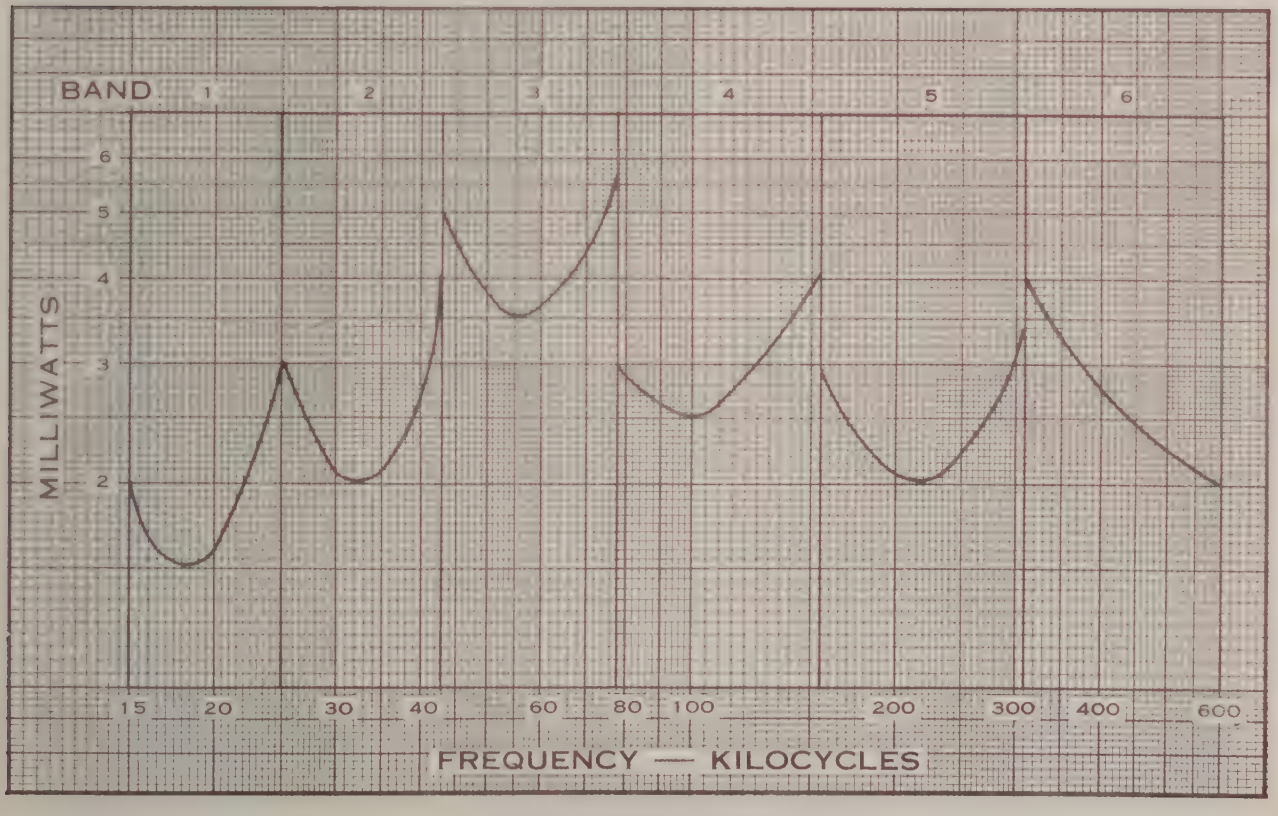



*Figure 9—Maximum Noise*

**CAUTION:** KEEP "SENSITIVITY" CONTROL RETARDED. Due to the high degree of sensitivity incorporated in the equipment, the "Sensitivity" control can only be used near maximum under ideal conditions of low external noise level. For ordinary operating conditions, it is necessary to retard the "Sensitivity" control in order to avoid OVERLOADING THE RECEIVER WITH NOISE, thereby masking the desired signal.

10.4–5 The "Regeneration" control should be set so that the detector is oscillating as evidenced by a double click heard in the headphones when the "Osc. Test" button is pressed and released.

10.4–6 The "Tuning" control should now be adjusted until the desired signal is heard and finally set to produce a 1000-cycle beat note as nearly as possible. The receiver should be tuned so that the beat note is obtained on the high-frequency side of zero beat. Finally, adjust the "Antenna Trimmer" and "RF Trimmer" for maximum signals.

10.4–7 In cases where the frequency of the signal is not known (such as when searching), excellent advantage may be taken of the uni-control feature, exercising care to keep the "Sensitivity" control to such a point as not to overload the receiver with noise.

10.4–8 The "AVC Level" control will maintain a substantially constant output signal level for wide fluctuation in the field intensity of the receiver signal and materially assist in copying signals through heavy static, because the static peaks are held to such a low value that the operator's attention is not distracted from copying the signals. To utilize this control, advance the "Sensitivity" control until the noise level is perceptible (not in excess of –10 db), then throw the "AVC Off-On" switch to the "On" position and adjust the "AVC Level" control until a copyable signal is obtained.

**NOTE:** TO USE THE "AVC LEVEL" CONTROL TO BEST ADVANTAGE, THE SIGNAL SHOULD BE HELD TO AS LOW A VALUE AS WILL PERMIT GOOD COPY.

10.4–9 Throwing the Audio Tuning "Off-On" switch to the "On" position will result in increased selectivity and reduced noise level permitting of improved reception. The desired signal may be tuned to produce any beat note within the range of 450 to 1300 cycles and audio tuning adjusted to produce a maximum response at this beat frequency. The following table shows an approximate calibration of the "Audio Tuning" control:

**TABLE No. 1 AUDIO TUNING**

| *Audio Tuning Switch 450-770* | | *Audio Tuning Switch 770-1300* | |
|---|---|---|---|
| Tap 1 | 450 cycles | Tap 1 | 800 cycles |
| 2 | 475 " | 2 | 845 " |
| 3 | 500 " | 3 | 890 " |
| 4 | 530 " | 4 | 940 " |
| 5 | 565 " | 5 | 990 " |
| 6 | 600 " | 6 | 1040 " |
| 7 | 640 " | 7 | 1100 " |
| 8 | 680 " | 8 | 1160 " |
| 9 | 725 " | 9 | 1225 " |
| 10 | 770 " | 10 | 1300 " |

10.5 ICW or Modulated Signal Reception.

10.5–1 The procedure is the same as outlined above with the exception that the "Regeneration" control should be maintained slightly below the setting which produces oscillation. There should not be a pronounced double click as the "Osc. Test" button is pressed and released.

10.5–2 Particularly on the higher frequencies, a considerable improvement in both sensitivity and selectivity results when the "Regeneration" control is set reasonably near but below the condition of oscillation.

10.5–3 This equipment *has not* been designed for reception of voice-modulated signals. If it is desired to receive voice-modulated signals in the range of 300 to 600 KC, these signals should be tuned in on other receiving equipment as may be available and suitable for voice reception. The low-pass filter permanently connected in the circuit does not respond to frequencies appreciably higher than 1200 cycles, which is inadequate for the proper reproduction of speech.

10.5–4 When receiving CW or ICW, the Audio Tuning "Off-On" switch should be thrown to the "ON" position. For reception of MCW signals, set the switch to the "OFF" position.

# XI
# PERFORMANCE

11.1 Sensitivity.

11.1–1 Figure 8 gives approximate normal sensitivities for the various bands. The procedure and conditions of measurement are as follows: with "AVC-Off," "Audio Tuning-Off," and with a 600-ohm non-inductive resistance at receiver output terminals, pure CW is applied from a signal generator to the receiver input through a standard dummy antenna (200 mmf., 20 microhenries, 25 ohms). The output beat note is held at 1000 cycles (receiver tuned 1 kilocycle higher than signal). The "Regeneration" control is set at standard oscillation (increased beyond critical oscillation to the point where the output drops 3 db or from 2.68 V. in 600 ohms at critical oscillation to 1.9 V. at standard oscillation). The "Sensitivity" control is set for 50 microwatts (0.173 V. in 600 ohms) noise output with no signal input. The microvolts input then required to produce 6 mw. output (1.9 V. in 600 ohms) is measured.

NOTE: THE CRITICAL OSCILLATION POINT IS THAT ADJUSTMENT OF THE "REGENERATION" CONTROL PRODUCING THE MOST FEEBLE OSCILLATIONS, RESULTING IN MAXIMUM OUTPUT. THIS CONDITION IS USUALLY TOO CRITICAL TO EMPLOY AS AN OPERATING ADJUSTMENT BUT IS A REFERENCE SETTING FOR STANDARD AND MEASUREMENT COMPARISON.

11.2 Maximum Noise.

11.2–1 Figure 9 shows approximate values of maximum receiver noise level for the various bands. This data will be found useful for a rough check on sensitivity. The method of measurement is to adjust the receiver as for sensitivity (see 11.1), switch off the signal generator, increase the "Sensitivity" control to maximum and measure the output noise voltage. The measured values of noise may be expected to vary considerably due to atmospheric conditions, tube characteristics, external noise conditions, etc. so that unless the noise output is definitely low, no attempt should be made to improve performance and, in any case, the sensitivity should first be accurately checked as explained in paragraph 11.1.

11.2–2 If measuring equipment is not available, an approximate measurement may be made by adjusting the "Regeneration" control to critical oscillation and all other controls for maximum noise output. The antenna terminal should be connected to ground through a standard dummy antenna or a 200 mmfd. capacitor inside the receiver cabinet (to eliminate external noise pickup). In this case the noise output should be approximately 3 db higher than the values shown in Figure 9. (This is twice the value of milliwatts shown therein.)

11.3 Selectivity and Overload Selectivity.

11.3–1 Figure 10 shows CW selectivity characteristics for bands 1, 2, and 3. The curves correspond closely with actual conditions at the middle of the band and represent an average for the band. This data is taken by first adjusting the receiver as for sensitivity measurements (par. 11.1) with 6 mw. output at resonance. The input (CW) signal frequency is then varied and the ratios of input off resonance (required to produce 6 mw. output) to the normal (resonant) input is noted. The break in the curve denotes the point where the signal is at *zero beat* with the autodyne detector.

11.3–2 Figure 11 shows selectivity and overload ratios for bands 4, 5, and 6. Curves (1) show the selectivity to 100% modulated interference when the receiver is operated for CW reception. They correspond closely with actual conditions at the middle of the band and represent an average for the band. This data is taken by first adjusting the receiver as for sensitivity measurement (par. 11.1) with 6 mw. output at resonance. The signal is then modulated 30% and the frequency varied. The ratios of inputs off resonance (required to produce 6 mw. output) to the normal (resonant) input are noted and the data corrected by multiplying by 3.33 to simulate 100% modulated interference.

11.3–3 Curves (2) of Figure 11 show the overload selectivity characteristics for bands 4, 5 and 6. The curves correspond closely with actual conditions at the middle of the band and represent an average for the band. This data is taken by first adjusting the receiver for sensitivity measurement (par. 11.1). With the resonant signal being received, a CW interfering signal is applied at various frequencies off resonance and the ratios of inputs off resonance (required to reduce the resonant signal output by 3 db) to the normal (resonant) input are noted.

11.4 Calibration.

11.4–1 Figure 12 shows average frequency calibration curves and band coverage of this equipment. Table No. 2 shows the nominal frequency range of each band.

**TABLE NO. 2**

| *Band* | *Frequency Range (Kilocycles)* |
|---|---|
| 1 | 15–25 |
| 2 | 25–43.5 |
| 3 | 43.5–77.5 |
| 4 | 77.5–153 |
| 5 | 153–308 |
| 6 | 308–600 |

## XII

## MAINTENANCE—TROUBLE LOCATION AND REMEDY

12.1 General.

12.1–1 This equipment has been carefully adjusted at the factory for optimum performance and is designed to maintain this adjustment for long periods of time. If any major adjustments or repairs become necessary it is recommended that such adjustments and repairs be made in a well equipped laboratory where the proper tools and measuring equipment are available. Before making any changes in receiver adjustment it should be definitely ascertained that the difficulty being experienced is not the result of external or normal deteriorating influences such as worn out vacuum tubes, improper operating voltages, blown fuses, external noises, etc.

**NOTE:** IN TESTING OR INSPECTING CIRCUITS IN THIS EQUIPMENT, CARE MUST BE EXERCISED NOT TO DISARRANGE R-F WIRING.

12.2 Equipment.

12.2–1 Where standard laboratory equipment is not available, the following equipment is recommended for use in locating troubles.

12.2–2 Radio Receiver Analyzing Equipment, Model OE (or equivalent), consisting of one Type CV-22193 DC Voltmeter Milliammeter Ohmmeter; one Type CV-22194 AC Voltmeter/Capacity Meter; one Type CV-60001 Vacuum Tube Circuit Selector Unit.

12.2–3 Calibrated Test Oscillator—frequency range 15 to 600 kilocycles.

12.3 Dead Receiver.

12.3–1 With "AVC-Off," "Audio Tuning-Off," and "Sensitivity" control at maximum, increase the "Regeneration" control setting from minimum to maximum, depressing the "Osc. Test" button at intervals. If no clicks or noises are heard in the phones on any band, the following procedure may be followed for location of trouble:

12.3–2 Check the vacuum tubes, particularly the detector tube.

12.3–3 Check the power supply (see 12.10).

12.3–4 Test the headphones and the output circuit wiring for short- or open-circuits.

12.3–5 Test the audio amplifier (see 12.11).

12.4 Weak Signals With Receiver Noise Level Normal.

12.4–1 If the receiver operates in a normal manner as indicated by the characteristic noise output (see 11.2) and no signals are in evidence, inspect the external antenna circuit.

12.4–2 Withdraw the chassis partially from the cabinet and inspect the antenna connections.

12.5 Weak Signals With Detector Failing to Oscillate on All Bands.

12.5–1 With "AVC-Off," and "Audio Tuning-Off," set the "Sensitivity" control at maximum, advance the "Regeneration" control and depress the "Osc. Test" button, noting whether the detector oscillates. If the detector fails to oscillate or oscillates with the "Regeneration" control near maximum on all bands, the following procedure should be followed:

12.5–2 Check the power supply (see 12.10).

12.5–3 Test the detector tube (see 12.13).

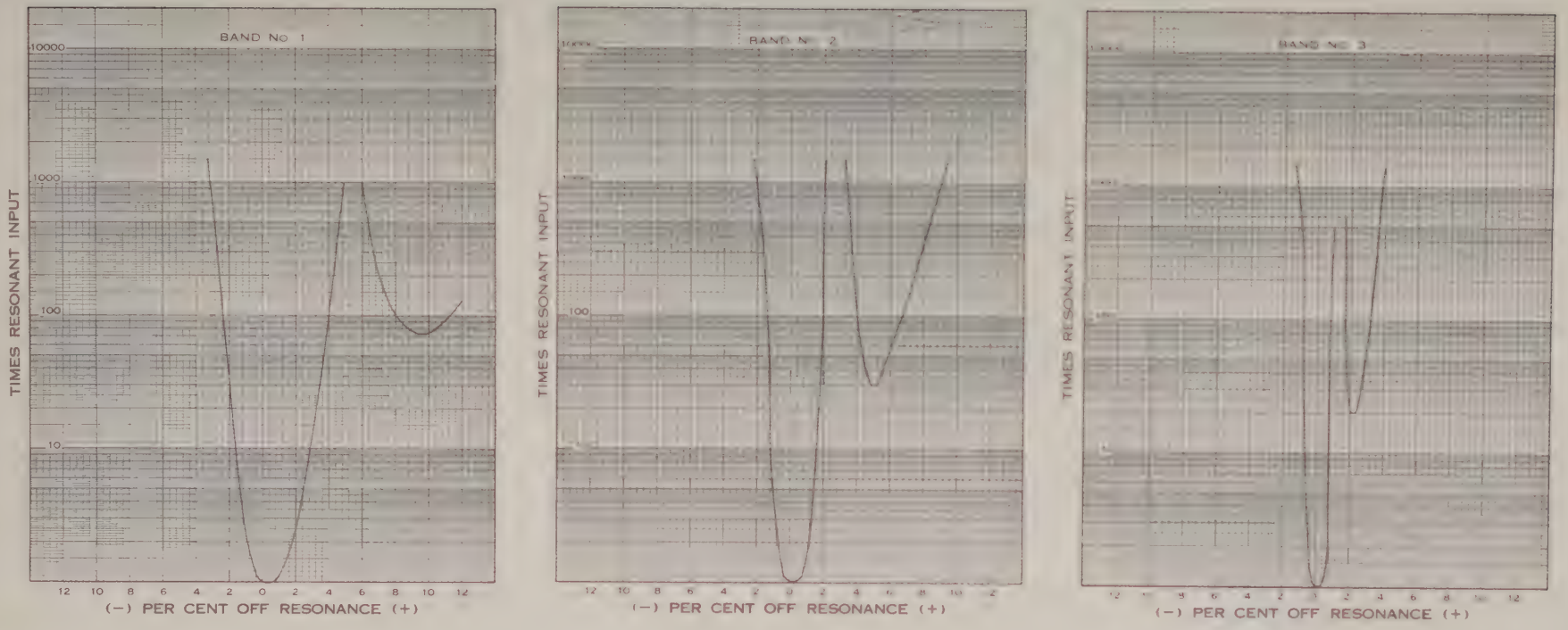



*Figure 10—Average Selectivity Curve—CW Interference—Bands 1, 2 and 3*

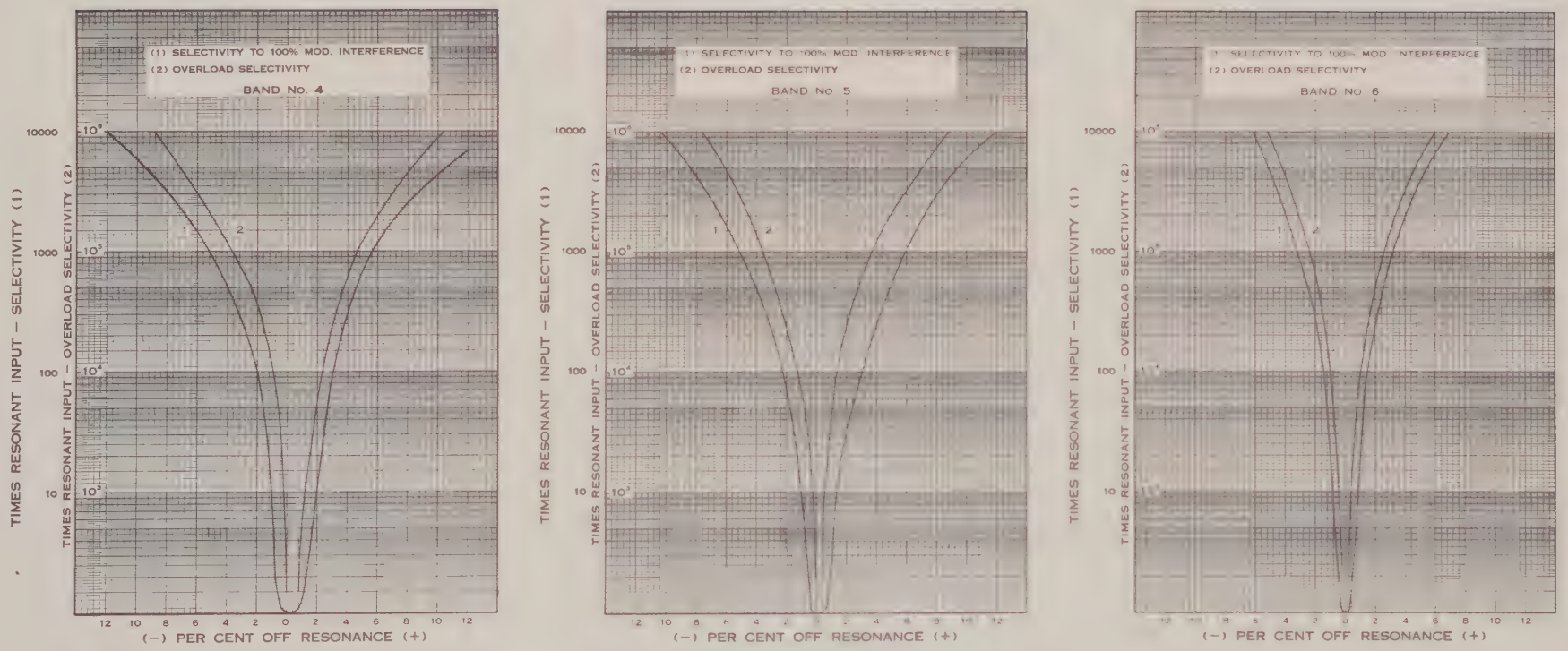



*Figure 11—Average Selectivity and Overload Selectivity*
*(1) Selectivity to 100% Mod. Interference; (2) Overload Selectivity*

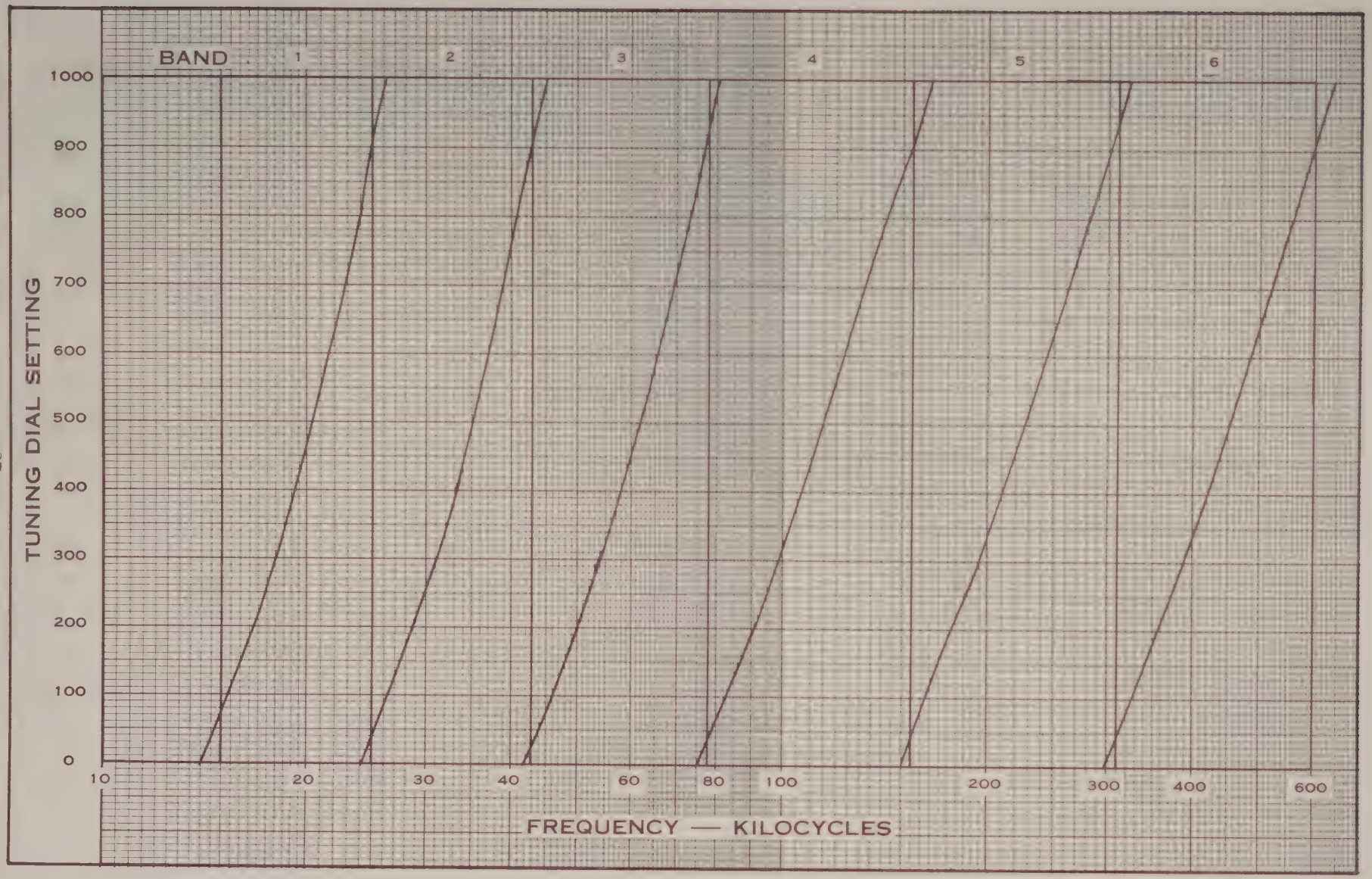



*Figure 12—Average Frequency Calibration Curves*

12.5–4 Test the detector tube socket voltages (see 12.14).

12.5–5 Test the detector circuit wiring (see 12.15).

12.5–6 Test the switch contacts (see 12.16).

12.6 Weak Signals with Detector Oscillating Normally.

12.6–1 Test the power supply (see 12.10).

12.6–2 Test the tubes (see 12.13).

12.6–3 If the power supply and the tubes are satisfactory and the receiver noise level is definitely low (see 11.2), the trouble may be located in the output circuit audio amplifier or r-f amplifier.

12.6–4 Test the output circuit and the headphones for short- and open-circuits. (If one side of the output circuit is grounded, the output will be reduced.)

12.6–5 Test the audio amplifier (see 12.11).

12.6–6 Test the r-f amplifier (see 12.12).

12.7 Failure of Detector to Oscillate on Some Bands; Other Bands Normal.

12.7–1 If the detector oscillates normally on part of the bands, it may be assumed that the power supply and the tubes are satisfactory and that the trouble is due to faulty band switch contacts or failure in the wiring between the band switch and portion of circuits used in the inoperative bands.

12.7–2 Test the r-f (plate) and detector tube socket voltages, switching the "Frequency Band" switch on and off of the inoperative bands (see 12.14).

12.7–3 Test the detector circuit wiring on inoperative bands (see 12.15).

12.8 Weak Signals on Some Bands; Other Bands Normal. Detector Oscillating Normally on All Bands.

12.8–1 If normal operation is obtained on part of the bands as indicated by normal receiver noise level (see 11.2) and if the detector oscillates normally on all bands, the trouble is localized in the portion of the r-f circuits connecting to the band switch in the inoperative bands.

12.8–2 Test the r-f tube socket voltages, switching the "Frequency Band" switch on and off of the inoperative bands (see 12.14).

12.8–3 Test the r-f circuit wiring on inoperative bands (see 12.15).

12.9 Panel Trimmer Controls.

12.9–1 Operation of these controls may be used as an indication of proper functioning of the associated tuned circuits.

12.9–2 In general, the settings for maximum response will vary for different bands and, in the case of the "Antenna Trimmer," for different antenna constants. These controls are designed to take care of normal minor variations in receiver alignment which occur over a period of time. A few divisions variation will normally occur over a given band due to slight mismatch of the inductances.

12.9–3 Failure of these controls to resonate the circuits as indicated by maximum response on a signal (with 1000-cycle beat note; receiver tuned 1 kilocycle higher than signal) on all bands indicates a defect in the respective circuit. Test the associated tube (see 12.13), tube socket voltages (see 12.14), and circuit continuity (see 12.15).

12.9–4 Failure of these controls to resonate the circuits on a particular band (other bands operating normally) indicates defects in the portion of the respective circuits connecting to the band switch on the particular band. Test the tube socket voltages (see 12.14), switching the "Frequency Band" switch on and off of the inoperative band. If the voltages and circuit continuity are correct, the receiver alignment should be investigated (see 12.17).

12.9–5 An abnormally large change in either trimmer setting over a given band or failure to resonate at only one end of a band indicates that the tuning capacitor section or the inductance used in the particular circuit and band has been damaged. If both

trimmer settings change in the same direction over a band, this may indicate that the detector tuning capacitor or inductance is at fault. (Refer to 12.17).

12.10 Power Supply.

12.10–1 If trouble is traced to the power supply, the following procedure may be followed:

12.10–2 Note the receiver panel voltmeter reading. This meter should read approximately 6 V. for normal operation and indicates the filament voltage which is obtained from a winding on the power transformer in the power unit. This also indicates that power is being supplied to the power unit and thus serves as a "power on" indicator.

12.10–3 If no voltage is indicated (assuming that the meter is not defective), test the a-c line voltage and fuses in the a-c line, control unit and power unit. Refer to Figure 15.

12.10–4 Partially remove the receiver from the cabinet and check the voltage at the power terminal board. Refer to Figure 15. The terminals are numbered from 1 to 9, No. 1 being nearest the panel. These voltages should measure approximately as follows:

**TABLE No. 3—RECEIVER TERMINAL VOLTAGES**

| *Terminal* | *Voltage* |
|---|---|
| 1 or 9 to 6 | 180 V. D.C. |
| 1 or 9 to 5 | 90 V. D.C. |
| 2 to 3 | 6 V. A.C. |

12.10–5 If voltages fail to check, test the a-c power supply voltage. Partially remove the power unit from its case and measure the power unit terminal voltages. Refer to Figure 15. The power unit terminals are numbered from 1 to 6, No. 1 being nearest the panel. These voltages should measure approximately as follows:

**TABLE No. 4**

**POWER UNIT TERMINAL VOLTAGES**

| *Terminal* | *Voltage* |
|---|---|
| 1 to 5 | 180 V. D.C. |
| 1 to 4 | 90 V. D.C. |
| 2 to 3 | 6.3 V. A.C. |

12.10–6 If the above voltages fail to check and the line input voltage and fuses are operative, test the power unit tubes (see 12.13).

12.10–7 Test the power unit circuits for continuity (see 12.15).

12.11 Audio Amplifier.

12.11–1 To determine if the audio amplifier is operating, partially withdraw the receiver from the cabinet and touch the grids of the detector and first a-f tubes. Pronounced clicks should be heard in the phones.

12.11–2 If the above test indicates a defect in the amplifier circuit with satisfactory power supply (see 12.10) and output circuit connections (see 12.3–3), the audio tubes should be checked (see 12.13) and the audio circuits tested (see 12.15).

12.11–3 If in the test of 12.11–1, a pronounced click is obtained when the first audio grid is touched, but touching the detector grid gives no indication, the trouble is located in the portion of the circuit between these two points.

12.11–4 If measuring equipment is available, the audio gain may be checked by application of 1000 cycles input to the first audio grid. The input required for zero level (6 milliwatts) output should be approximately 0.04 volt.

12.12 R-F Amplifier.

12.12–1 A defective r-f amplifier may be detected by abnormal operation of the trimmer controls (see 12.9), "Sensitivity" control, or by first ascertaining that the remainder of the circuit is operative.

12.12–2 With the "Sensitivity" control at minimum, a barely audible hum should be noted and it should be possible to hear the detector go into oscillation if the "Regeneration" control is advanced rapidly. With the detector oscillating, the characteristic double click should be heard when the "Osc. Test" button is depressed. Further tests indicating normal operation of detector output and audio amplifier circuits are noted under 12.11.

12.12–3 If a fault is located in the r-f amplifier by the above methods with normal power supply (see 12.10) and antenna connections (see 12.4–2), it should be determined whether the trouble exists on all bands or on only one or more particular bands.

12.12–4 If the trimmer operation is not normal, refer to paragraph 12.9.

12.12–5 If the trimmer operation is normal and low sensitivity is indicated by the tests outlined in paragraph 11.1 is obtained on all bands, test the r-f amplifier tubes (see 12.13), socket voltages (see 12.14) and circuit continuity (see 12.15).

12.12–6 If trouble is located on a particular band or bands with other bands operating normally, check the socket voltages (see 12.14) and circuit continuity (see 12.15), switching the "Frequency Band" switch on and off the inoperative band. Check the "Frequency Band" switch (see 12.16).

12.12–7 Before making extensive circuit tests, an attempt should be made to localize the trouble in the first or second amplifier stage. This may be done by applying input from a test oscillator to the respective grids.

12.13 Tube Characteristics.

12.13–1 If trouble is traced to tubes in a portion of the circuit, the trouble may be quickly checked by replacing the doubtful tube with a tube of known characteristics and rechecking the performance of the equipment.

12.13–2 Tubes may be tested for open heaters or shorts between elements by use of a continuity meter or click test with the precaution that the rated heater voltage is not exceeded.

12.13–3 Tubes will be found to deteriorate gradually with use, resulting in a gradual reduction in performance of the equipment. It is therefore advisable to replace tubes after 1000 hours of service or to measure them at regular intervals to determine if the limit of serviceability has been reached. Table No. 5 gives standard characteristics for the tubes used in this equipment and low limits of "emission" and "transconductance." Test of "emission" is usually sufficient to indicate the condition of a tube, but a better correlation between test results and actual conditions is obtained by measurement of "transconductance." Actual operating voltages on the tubes as used in this equipment are appreciably lower than the ratings shown in the table, so that extended tube life is assured.

**TABLE No. 5—TUBE CHARACTERISTICS**

| Tube Type | Fil. Volts | Fil. Current (Amps.) | Plate Volts | Screen Volts | Grid Bias Volts | Plate Current (MA.) | *Emission Current (MA.) | Screen Current (MA.) | AC Plate Resistance (Ohms) | Ampl. Factor | Average Transcond. (Micromhos) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -6D6 | 6.3 | 0.3 | 250 | 100 | – 3 | 8.2 | 100 | 2.0 | 800,000 | 1280 | 1600 |
| -41 | 6.3 | 0.4 | 250 | 250 | –18 | 32 | 200 | 5.5 | 68,000 | 150 | 2200 |
| -874 | .. | .. | 90 | .. | .. | 30 | .. | (striking voltage 125 V.) | | | |
| -876 | 50.0 | 1.7 | .. | .. | .. | .. | .. | .. | ..... | .... | .... |
| -5Z3 | 5.0 | 3.0 | .. | .. | .. | .. | 240 | .. | ..... | .... | .... |
| -5Z3 | (AC voltage per plate 500 RMS—Max. DC Output Current 250 MA.) | | | | | | | | | | |

| Tube Type | Low Limits *Emission (MA.) | Low Limits Transconductance (Micromhos) |
|---|---|---|
| -6D6 | 50 | 1200 |
| -41 | 70 | 1300 |
| -876 | .. | .... |
| -874 | .. | .... |
| -5Z3 | 190 | .... |

* For "emission" tests, all grids are connected to the plate and are 50 volts positive with respect to the cathode (or filament), except the Type -5Z3 tube on which a potential of 40 volts is used with both plates connected together.

12.13–4 Measurement of "emission" and "transconductance" is not always an absolute indication of the condition of tubes for their various applications, particularly in the case of detector and AVC tubes. An unsatisfactory detector tube is best indicated

by its oscillating properties. A tube which does not function properly in the detector stage may often be used in an amplifier stage without loss in performance. A low output tube may often be utilized in the AVC position.

12.14 Tube Socket Voltages.

12.14–1 Measurement of socket voltages may be used as a check on power supply and receiver circuit connections.

12.14–2 The following table gives average tube socket voltages for this equipment. These are not operating voltages and will vary considerably with different types of voltmeters. The values stated below apply for the Model OE Radio Receiver Analyzing Equipment.

**TABLE No. 6—TUBE SOCKET VOLTAGES**

Due to the change in load when one tube is removed, the voltages measured at the tube sockets are somewhat higher than the corresponding voltages of Tables 3 and 4.

| *Tube Type* | *Function* | *Plate* | *Screen* | *Supp.* | *Cath.* | *Grid* | *Heater* |
|---|---|---|---|---|---|---|---|
| -6D6 | 1st RF | 190 | 94 | 5 | 5 | 0 | 6 |
| -6D6 | 2nd RF | 180 | 94 | 5 | 5 | 0 | 6 |
| -6D6 | Detector | 170 | 45 | 0 | 0 | 0 | 6 |
| -6D6 | Audio | 190 | 180 | 0 | 0 | 0 | 6 |
| -41 | Output | 200 | 200 | .. | 0 | 0 | 6 |
| -41 | AVC | 0 | 0 | .. | 190 | 0 | 6 |

In making the above measurements, the receiver should be operated at normal supply voltage and allowed to warm up for approximately 10 minutes before taking readings. Readings are taken by removing one tube at a time and measuring voltages between the socket terminals and ground. Set "Frequency Band" switch on "6," "Tuning—1000," "Audio Tuning—Off," "AVC-Off," "Sensitivity—10" and "AVC Level—10." Figure 13 shows socket terminal arrangements.

**TABLE No. 6a—TUBE OPERATING VOLTAGES AND CURRENTS**

| *Tube* | *Function* | *Plate* E | *Plate* MA. | *Screen* E | *Screen* MA. | *Cathode* E | *Supp.* E | *Heater* E | *Note* |
|---|---|---|---|---|---|---|---|---|---|
| -6D6 | 1st RF | 150 | 3.0 | 70 | 0.7 | 3.5–45 | 3.5–45 | 5.6 (AC) | 1 |
| -6D6 | 2nd RF | 105 | 3.5 | 73 | 0.8 | 3.0–45 | 3.0–45 | 5.6 (AC) | 1 |
| -6D6 | Detector | 20–140 | 0.0–1.0 | 0–40 | 0.0–0.3 | 0 | 0 | 5.6 (AC) | 2 |
| -6D6 | Audio | 25 | 1.3 | 35 | 0.35 | 1.6 | 1.6 | 5.6 (AC) | |
| -41 | Output | 110 | 11.0 | 120 | 1.7 | 7.8 | —— | 5.6 (AC) | |
| -41 | AVC | 0 | 0 | 0 | 0 | 175 | —— | 5.6 (AC) | 3 |
| -5Z3 | Rectifier | 230 AC — from each plate to ground. | | | | | | 4.8 (AC) | |

The above are average operating voltage and current values as obtained by measurement with a Model OE Radio Receiver Analyzing Equipment. Readings were taken under the following test conditions: Receiving Equipment in normal operative condition, antenna disconnected, line voltage 115, current-regulator tube *out*, "AVC-Off," "Sensitivity" control on 10 (see Note 1), "Regeneration" control on 5 (see Note 2), "Frequency Band" switch on "1," and "Tuning" control on 0–0. DC voltages measured to heater (ground).

Note 1. Cathode to heater voltage varies with position of "Sensitivity" control. Average limits are shown.

Note 2. Detector voltages and currents vary with position of "Regeneration" control. Average limits are shown.

Note 3. Cathode to heater voltage measured with "AVC Level" control at maximum.

For the above measurements with Model OE Radio Receiver Analyzing Equipment, the lowest possible voltmeter scale should be used, as follows:

| *Voltages* | *Meter* | *Resistance* | *Voltages* | *Meter* | *Resistance* |
|---|---|---|---|---|---|
| 0/1 | 0/1 | 20,000 | 10/25 | 0/25 | 500,000 |
| 1/2.5 | 0/2.5 | 50,000 | 25/50 | 0/50 | 1,000,000 |
| 2.5/5 | 0/5 | 100,000 | 50/100 | 0/100 | 2,000,000 |
| 5/10 | 0/10 | 200,000 | 100/250 | 0/250 | 5,000,000 |

12.14–3 If trouble exists on a particular band, the tube socket voltages should be measured on both the inoperative band and on an operative band to indicate which portion of the circuit is at fault.

12.14–4 If a source of trouble is localized in a particular portion of the circuit by the above analysis, this portion of the circuit should be inspected and tested for continuity (see 12.15).

12.15 Circuit Continuity.

12.15–1 After tracing a fault to a particular portion of the circuit by the foregoing tests, the circuit should be systematically inspected, tested for continuity, short circuits, ground or failure of component parts, with power off. Refer to following drawings:

| *Diagram* | *Figure* |
|---|---|
| Receiver Unit Schematic | 16 |
| Receiver Unit Connection | 19 |
| Power Unit Schematic | 17 |
| Power Unit Connection | 20 |

12.15–2 If an ohmmeter is available, point-to-point resistance measurements will be useful in locating faults. The following tables indicate the approximate resistances in this equipment.

**TABLE No. 7—RECEIVER UNIT POINT-TO-POINT RESISTANCES**

| *Points* | | *Resistance* | | *Condition* |
|---|---|---|---|---|
| Terminal No. 6 to | 1st RF plate | 10,500 | ohms | |
| " " | 2nd RF plate | 20,500 | ohms | |
| " " | Detector plate | 120,000 | ohms | |
| " " | Audio plate | 120,000 | ohms | |
| " " | Output plate | 5,125 | ohms | "AVC-Off" |
| " " | Output plate | 4,800 | ohms | "AVC-On" |
| Terminal No. 6 to | AVC cathode | 0 | ohms | "AVC Level — 10" |
| " " | AVC cathode | 9,200 | ohms | "AVC Level — 0" |
| " " | 1st RF screen | 20,000 | ohms | |
| " " | 2nd RF screen | 20,000 | ohms | |
| " " | 1st AF screen | 390,000 | ohms | |
| " " | Ground | 9,200 | ohms | |
| Terminal No. 5 to | Detector screen | 28,800 | ohms | "Regeneration — 10" |
| Ground to | Detector screen | 10,000 | ohms | "Regeneration — 0" |
| " " | 1st RF grid | 230 | ohms | "Frequency Band — 1" |
| " " | 2nd RF grid | 4.7 | megohms | |
| " " | Detector grid | 4.7 | megohms | |
| " " | Audio grid | 1.1 | megohms | |
| " " | Output grid | 1.0 | megohms | |
| " " | AVC-Screen-grid-plate | 3,500 | ohms | |
| Terminal No. 7 to No. 8 | | 40 | ohms | "Add Decibels-Off" |
| Ground to No. 7 | | 20 | ohms | "Add Decibels-Off" |
| " " " 8 | | 20 | ohms | "Add Decibels-Off" |

The above values apply for receiver unit alone — external cables disconnected, all tubes out of sockets and receiver set on "Frequency Band—1," and "Tuning—0."

12.15–3 Power unit point-to-point resistances are approximately as noted in the following table:

**TABLE No. 8**

**POWER UNIT POINT-TO-POINT RESISTANCES**

| *Points* | *Resistance* | | *Condition* |
|---|---|---|---|
| Terminal No. 2 to No. 3 | 1.0 | ohms | |
| Terminal No. 1 to No. 5 | 20,000 | ohms | |
| Terminal No. 1 to No. 4 | 23,000 | ohms | |
| -5Z3 socket (fil. to fil.) | 0.15 | ohms | |
| -5Z3 socket (plate to plate) | 250 | ohms | |
| R-H power line terminals | Infinite | | "On-Off" Switch—"Off" |
| R-H power line terminals | 7.0 | ohms | "On-Off" Switch—"On" |
| Power terminal to ground | Infinite | | |

Above values apply for the power unit alone (external cables and wiring disconnected) with all tubes in sockets and with current-regulator tube *out* (the condition of operation of the power unit with this equipment).

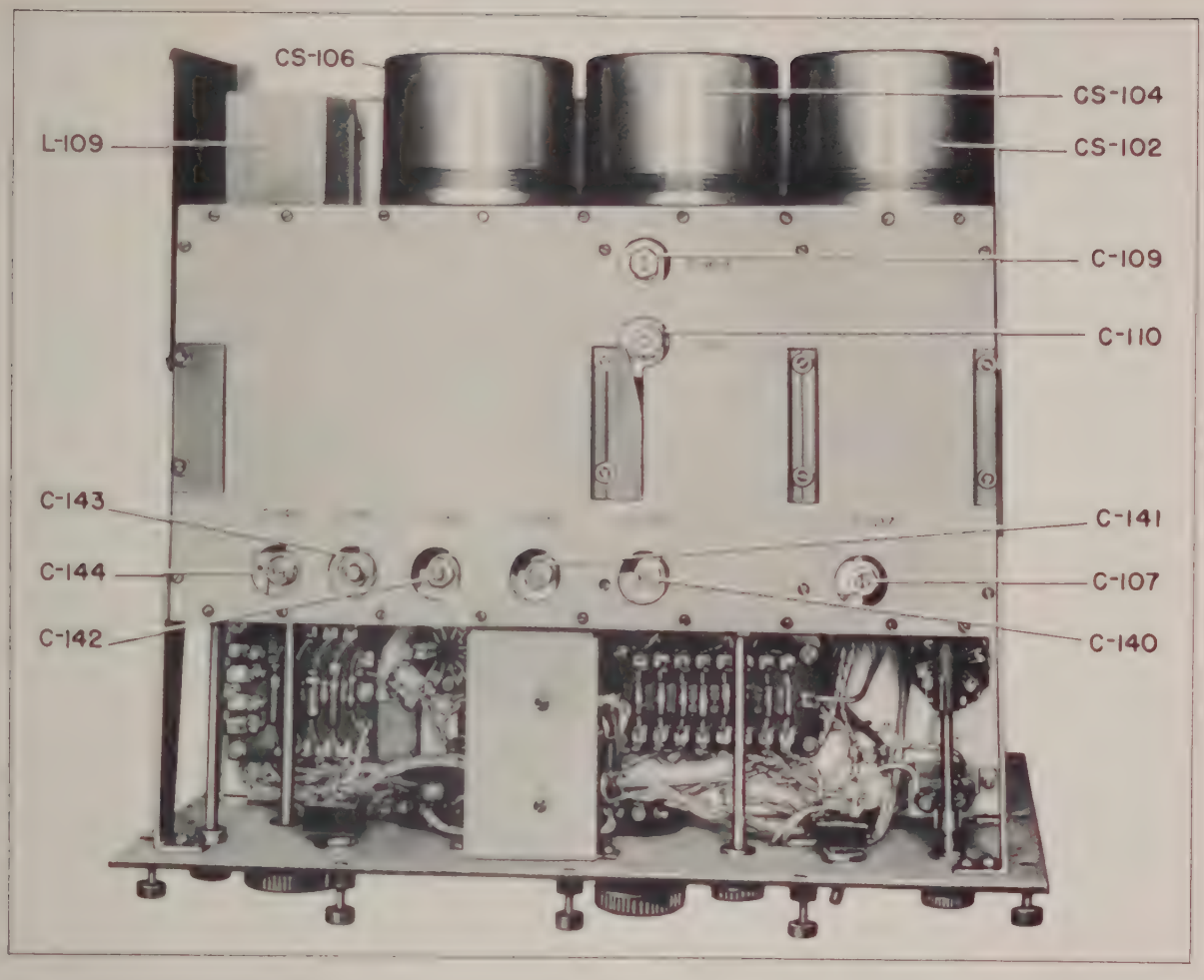



*Figure 13—Receiver Unit CMX-46155-A (Bottom View of Chassis)*

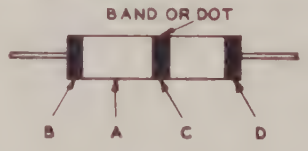
12.15–4 Component parts may be identified by cross reference from the item numbers in Figures 16 and 17.

12.15–5 Carbon resistors may be identified by color code as follows:

**TABLE No. 9—RMA COLOR CODE FOR RESISTORS**

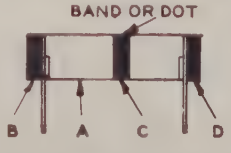
| | A | B | C |
|---|---|---|---|
| *Color* | *1st Digit* | *2nd Digit* | *Ciphers* |
| Black | .. | 0 | 0 |
| Brown | 1 | 1 | 0 |
| Red | 2 | 2 | 00 |
| Orange | 3 | 3 | 000 |
| Yellow | 4 | 4 | 0000 |
| Green | 5 | 5 | 00000 |
| Blue | 6 | 6 | 000000 |
| Purple | 7 | 7 | 0000000 |
| Grey | 8 | 8 | 00000000 |
| White | 9 | 9 | ..... |

D—Tolerance Code
Gold: 5%
Silver: 10%
Omit: 20%




Original Color Arrangement for Axial Leads

New Color Arrangement for Axial Leads




Standard Color Arrangement for Radial Leads

12.16 "Frequency Band" Switch.

12.16–1 To inspect the "Frequency Band" switch and circuit connections, the large plate on the bottom of the chassis may be removed. This switch has been carefully aligned

at the factory, the four contacts on each section being accurately adjusted for equalized pressure and maximum contact area. Readjustments of the switch should rarely be found necessary.

IF ANY MAJOR REPAIRS ON THE SWITCH ASSEMBLY ARE FOUND NECESSARY, SUCH REPAIRS SHOULD BE MADE IN A WELL EQUIPPED LABORATORY SINCE SERIOUS MECHANICAL MISALIGNMENT OF THE CONTACTS OR MISALIGNMENT OF HIGH-FREQUENCY INDUCTANCES DUE TO DERANGEMENT OF R-F WIRING MAY RESULT.

In order to readjust or replace switch parts and for access to switch wiring, it will be necessary to remove the switch retaining brackets mounted inside the switch compartments at the bottom of the chassis. After removal of the large plate on the bottom of the chassis, the switch retaining bracket for a particular compartment may be removed without removing the brackets for other compartments. The brackets are mounted by means of screws at the partition shields.

When the switch retaining bracket is replaced, the switch stator sections must be first accurately positioned so that the movable contacts exactly center on the fixed contacts when the switch is set to positions determined by the detent. The retaining bracket is then mounted in position with the adjusting screws backed off. Finally, the adjusting screws must be screwed in to just touch the stators, then backed off to leave a very slight clearance (approximately .005 in.), then locked by means of the lock nuts. UNDER NO CONDITION SHOULD SCREWS EXERT FORCE AGAINST THE STATORS AS THIS WILL CAUSE BENDING WITH CONSEQUENT BINDING OF THE SWITCH SHAFT.

**CAUTION:** DO NOT ALIGN BY MEANS OF SCREWS.

12.16–2 Switch contacts may be tested by pressing the movable contact down on its fixed contact with a tool of insulating material. Associated circuits should be checked for loose contacts before disturbing the switch assembly.

12.16–3 The switch is self-cleaning and should wipe itself clean if rotated back and forth over the questionable contact several times. Should further cleaning become necessary, the rotating member may be pressed down against the fixed member far enough to permit disengaging the "C" washer from its slot in the rotating hub at the back of the fixed member. If the "C" washer is removed, the rotating member may be slid along the shaft away from the fixed member permitting access to the contacts. Care must be taken not to compress the springs farther than necessary or they will require readjustment.

12.16–4 Should necessity of replacing a switch section arise, the switch shaft must be removed, the switch section connections unsoldered at the switch plate, the new section inserted, connections soldered, and switch shaft replaced. Receiver alignment should then be checked (see 12.17). To remove switch shaft, remove taper pin fastening the bevel gear to the switch shaft. Remove the bearing bushing at the end of the shaft opposite the drive and slide the shaft out, taking care that none of the switch sections are binding on the shaft. When replacing the shaft, see that the bevel gears are properly meshed to provide alignment between switch position and position indicated by the panel control before pinning.

12.17 Receiver Alignment.

12.17–1 Receiver alignment may be readily checked by observing operation of the panel trimmers (see paragraph 12.9 and Figure 6). These trimmers should resonate the respective tuned circuits (with 1000-cycle beat note output; receiver tuned 1 kilocycle higher than the signal) over the complete range. For accurate alignment check, the receiver must be adjusted as for sensitivity measurements (see 11.1). This adjustment may be approximated with sufficient accuracy for most purposes by setting the "Sensitivity" control at "9" and the "Regeneration" control at approximately ½ division above critical oscillation. The beat note may be set at approximately 1000 cycles by switching the Audio Tuning "On," using the "770-1300" range (tap 5), and tuning for maximum output.

12.17–2 Bands 4, 5 and 6: With receiver adjustments as noted above, set "Tuning—905," "Frequency Band—6," apply a 600-kc signal from test oscillator of such strength as to produce approximately 6 mw. output and adjust trimmer C-141 to produce 1000-cycle beat note (receiver 1 kilocycle higher than signal). Adjust trimmer C-140 to bring the panel "RF Trimmer" settings for the high-frequency ends of Bands 4, 5 and 6 as near zero as possible. Adjust trimmer C-107 to bring panel "Antenna Trimmer" settings for the high-frequency ends of Bands 4, 5 and 6 as near "–10" as possible, but not exceeding the limits "–7" to "–20" ("–50" being the minimum capacity setting).

12.17–3 Band 3: With "Tuning—906.5," apply 77.5 kc input. Adjust detector trimmer C-142 to produce 1000-cycle beat note (receiver 1 kilocycle higher than signal). With the panel "RF Trimmer" set at zero, adjust r-f trimmer C-110 for maximum response.

12.17–4 Band 2: With "Tuning—915" apply 43.5 kc input. Adjust detector trimmer C-143 to produce 1000-cycle beat note (receiver 1 kilocycle higher than signal). Adjust r-f trimmer C-109 to bring the panel "RF Trimmer" settings at the high-frequency ends of Bands 1 and 2 as near zero as possible.

12.17–5 Band 1: With "Tuning—891" apply 25 kc input. Adjust detector trimmer C-144 to produce 1000-cycle beat note (receiver 1 kilocycle higher than signal).

12.17–6 The following table gives nominal frequencies and approximate dial settings which should be used in aligning the receiver.

**TABLE No. 10**

**ALIGNING FREQUENCIES**

| *Band* | *(Nominal Frequency KC)* | *Dial Setting (Approx.)* |
|---|---|---|
| 1 | 15 -25 | 89-891 |
| 2 | 25 -43.5 | 55-915 |
| 3 | 43.5-77.5 | 49-906.5 |
| 4 | 77.5-153 | 40-915 |
| 5 | 153 -307 | 49-925.5 |
| 6 | 307 -600 | 45-905 |

12.17–7 As noted in paragraph 12.9–5, an abnormal change in either trimmer setting over a given band or failure to resonate at one end of a band indicates that the tuning capacitor section or the inductance used in the particular circuit and band has been damaged. If both trimmer settings change in the same direction over a band, this may indicate that the detector tuning capacitor or inductance is at fault.

UNLESS THESE CONDITIONS SERIOUSLY IMPAIR OPERATION, NO ATTEMPT SHOULD BE MADE TO REPAIR INDUCTANCE OR TUNING CAPACITOR ALIGNMENT OR REPLACE COILS. THESE OPERATIONS SHOULD VERY RARELY BECOME NECESSARY AND SHOULD BE DONE ONLY IN A WELL EQUIPPED LABORATORY.

12.18 Lubrication.

12.18–1 Mechanical moving parts such as the tuning capacitor drive mechanism, band switch drive mechanism, and bearings should be periodically inspected and, if necessary, lightly greased with a non-fluid mineral oil or light grease such as grade A of Navy Department Specification 14G 1. Lubrication of electrical contacting surfaces is not advisable unless tendency for cutting appears; when required, a light grease such as vaseline should be used very sparingly, all surplus grease being removed.

12.19 Cleaning.

12.19–1 ABRASIVE SUBSTANCES SUCH AS EMERY CLOTH, STEEL WOOL, ETC., SHOULD NEVER BE USED FOR CLEANING IN OR NEAR ANY PART OF THIS EQUIPMENT.

| NAVY TYPE NUMBER | NAME OF MAJOR UNIT | PART DESIGNATION GROUP |
|---|---|---|
| CMX-46155-A | Receiver Unit for Model RAK-8 Equipment | 101–199 |
| CMX-20131-A | Power Unit for Model RAK-8 Equipment | 201–299 |
| CMX-23073-A | Control Unit for optional use with Models RAK-8 and RAL-8 | 301–399 |

## 13.1 TABLE No. 11
## PARTS LIST BY SYMBOL DESIGNATIONS
Receiver Unit CMX-46155-A

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | | CAPACITORS | | | | | |
| *C-101 | | Antenna series capacitor used with COMMON antenna connection | Molded mica, 300 mmf. ±10%, 500 V. D.C. (working) | | | Sangamo | | B250073G145 |
| *C-102 | | Antenna coupling capacitor on Band 2 | Molded mica, 1200 mmf. ±5%, 500 V. D.C. (working) | | | Micamold, Sangamo or Solar | | C250109G1040 |
| *C-103 | | Antenna coupling capacitor on Band 1 | Molded mica, 820 mmf. ±5%, 500 V. D.C. (working) | | | Micamold, Sangamo or Solar | | C250109G1036 |
| *C-104 | | Antenna coupling capacitor on Band 3 | Molded mica, 62 mmf. ±2%, 500 V. D.C. (working) | | | Micamold or Solar | | C250107G2003 |
| C-105 | A | Main tuning on 1st R.F. stage | Three-gang variable, 26.3 ±1 to 476* ±14 mmf. per section | | | Hammarlund Mfg. Co. | | XD260037G1 |
| | B | Main tuning on 2nd R.F. stage | | | | | | |
| | C | Main tuning on Detector stage | | | | | | |
| *C-106 | | ANTENNA TRIMMER on 1st R.F. stage | Variable air trimmer, 6 to 60 mmf. 8 plate | §-48578 | | Hammarlund or Bud Radio | | B260036G4 |
| *C-107 | | In series with C-106 for 1st R.F. fixed alignment on H.F. bands 4, 5 and 6 | Variable air trimmer, 6 to 50 mmf. 7 plate | §-48577 | | Hammarlund or Bud Radio | | B260036G3 |
| *C-108 | A | Cathode R.F. filter by-pass on 1st R.F. tube | Paper, oil-filled, 2-section, 0.5 — 0.5 mfd. ±15%, 250 V. D.C. (working) | CBV-18556-15 | RE-13A-488 | John E. Fast Company | | B250102G2 |
| | B | Screen R.F. filter by-pass on 1st R.F. tube | | | | | | |
| *C-109 | | Aligning capacitor for Bands 1 and 2 on 2nd R.F. stage | Variable air trimmer, 6 to 80.4 mmf. 15 plate | □-48580 | | Oak or Cardwell | | B260035G1 |
| *C-110 | | Aligning capacitor for Band 3 on 2nd R.F. stage | Same as C-109 | □-48580 | | | | |
| *C-111 | | R.F. TRIMMER on 2nd R.F. stage | Variable air trimmer, 5.3 to 27 mmf. 4 plate | §-48575 | | Hammarlund or Bud Radio | | B260036G1 |

* Spare parts furnished for all items preceded by an asterisk.
§ CHC or CDB.
□ COC or CBK.

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| *C-112 | | Grid coupling between 1st and 2nd R.F. stages | Molded mica, 510 mmf. ±5%, 500 V. D.C. (working) | | | Micamold, Sangamo or Solar | | C250107G1064 |
| C-113 | A | Plate supply by-pass on 1st R.F. tube | Same as C-108 | | | | | |
| | B | Plate supply by-pass on 1st R.F. tube | | | | | | |
| *C-114 | A | Plate supply by-pass on 1st R.F. tube | Paper, oil-filled, 2-section, 0.5 — 0.5 mfd. ±15%, 250 V. D.C. (working) | CBV-48554-15 | RE-13A-488 | John F. Fast Company | | B250101G4 |
| | B | Plate supply by-pass on 2nd R.F. tube | | | | | | |
| *C-115 | A | Cathode R.F. filter by-pass on 2nd R.F. tube | Same as C-108 | CBV-48556-15 | | | | |
| | B | Screen R.F. filter by-pass on 2nd R.F. tube | | | | | | |
| *C-116 | | Cathode by-pass on 2nd R.F. tube | Paper, oil-filled, 1.0 mfd. ±10%, 250 V. D.C. (working) | CBV-48553-10 | RE-13A-488 | John E. Fast Company | | B250101G3 |
| *C-117 | | 2nd R.F. plate supply by-pass | Same as C-116 | CBV-48553-10 | | | | |
| *C-118 | | Grid coupling between 2nd R.F. and detector stages | Same as C-112 | | | | | |
| *C-119 | | Detector screen filter by-pass | Same as C-116 | CBV-48553-10 | | | | |
| *C-120 | | Detector screen R.F. filter by-pass | Same as C-108 | CBV-48556-15 | | | | |
| *C-121 | | Detector plate filter by-pass | Same as C-116 | CBV-48553-10 | | | | |
| *C-122 | | Coupling capacitor between detector plate and low-pass filter L-107 | Molded mica, .01 mfd. ±10%, 600 V. D.C. (working) | | | Micamold or Sangamo | | C250106G1148 |
| *C-123 | | R.F. by-pass on grid of 1st audio tube | Molded mica, 100 mmf. ±5%, 500 V. D.C. (working) | | | Micamold or Solar | | C250107G1047 |
| *C-124 | | Cathode by-pass on 1st audio tube | Same as C-116 | CBV-48553-10 | | | | |
| *C-125 | | Screen by-pass on 1st audio tube | Same as C-116 | CBV-48553-10 | | | | |
| *C-126 | | Screen and plate by-pass on output tube | Same as C-116 | CBV-48553-10 | | | | |
| *C-127 | | Plate filter by-pass on 1st audio tube | Same as C-116 | CBV-48553-10 | | | | |
| *C-128 | | Plate by-pass on 1st audio tube | Molded mica, .001 mfd. ±10%, 2500 V. D.C. (working) | | | Micamold or Sangamo | | C250106G1136 |
| *C-129 | | Coupling capacitor between 1st audio and output tubes | Molded mica, .002 mfd. ±5%, 1200 V. D.C. (working) | | | Micamold | | C250106G1099 |
| *C-130 | | Cathode by-pass on output tube | Same as C-116 | CBV-48553-10 | | | | |
| *C-131 | | Cathode by-pass on output tube | Same as C-116 | CBV-48553-10 | | | | |
| *C-132 | | Cathode by-pass on output tube | Same as C-116 | CBV-48553-10 | | | | |
| *C-133 | | Plate by-pass on output tube | Same as C-122 | | | | | |
| *C-134 | | Cathode by-pass on A.V.C. tube | Same as C-116 | CBV-48553-10 | | | | |

* Spare parts furnished for all items preceded by an asterisk.

## 13.1 TABLE No. 11 (Continued)
## PARTS LIST BY SYMBOL DESIGNATIONS
### Receiver Unit CMX-46155-A

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| *C-135 | | Input filter by-pass on 90-volt "B" supply | Same as C-116 | CBV-48553-10 | | | | |
| *C-136 | | Input filter by-pass on 180-volt "B" supply | Same as C-116 | CBV-48553-10 | | | | |
| *C-137 | | Input filter by-pass on 6-volt positive supply | Same as C-116 | CBV-48553-10 | | | | |
| *C-138 | | Input filter by-pass on 6-volt negative supply | Same as C-116 | CBV-48553-10 | | | | |
| *C-139 | | Antenna coupling capacitor on H.F. bands 4, 5 and 6 | Silver mica, 45.4 mmf. ±2%, 500 V. D.C. (working) | | | Micamold or Solar | | B250085G23 |
| *C-140 | | 2nd R.F. fixed aligning capacitor on H.F. bands 4, 5 and 6 | Same as C-107 | §-48577 | | | | |
| *C-141 | | Detector aligning capacitor on H.F. bands 4, 5 and 6 | Variable, air trimmer, 7.5 to 80 mmf., 11 plate | §-48579 | | Hammarlund or Bud Radio | | B260036G3 |
| *C-142 | | Detector aligning capacitor on band 2 | Same as C-141 | §-48579 | | | | |
| *C-143 | | Detector aligning capacitor on band 2 | Variable air trimmer, 9 to 125 mmf. 23 plate | □-48581 | | Oak or Cardwell | | B260035G2 |
| *C-144 | | Detector aligning capacitor on band 1 | Same as C-143 | □-48581 | | | | |
| *C-145 | | Detuning capacitor across L.F. coil on band 5 | Molded mica, 910 mmf. ±5%, 500 V. D.C. (working) | | | Micamold or Solar | | C250109G1037 |
| *C-146 | | Series tuning capacitor used with variable attenuator L-108 | Paper, oil-filled, .025 mfd. ±10%, 600 V. D.C. (working) | CBV-48806-10 | | John E. Fast Company | | B250101G1 |
| *C-147 | | Series tuning capacitor used with variable attenuator L-108 | Paper, oil-filled, .075 mfd. ±10%, 600 V. D.C. (working) | CBV-48807-10 | | John E. Fast Company | | B250101G2 |
| *C-148 | | Output cable filter by-pass | Molded mica, .01 mfd. ±10%, 300 V. D.C. (working) | | | | | C250111G1046 |
| *C-149 | | Output cable filter by-pass | Same as C-148 | | | | | |
| *C-150 | | Output jack filter by-pass | Same as C-148 | | | | | |
| *C-151 | | Output jack filter by-pass | Same as C-148 | | | | | |
| | | | COIL SHIELDS | | | | | |
| CS-101 | | Shield for L-101 | Coil shield, copper, threaded, 4" dia., 5¼" long | | | Aluminum Goods Company | | B631270G2 |

* Spare parts furnished for all items preceded by an asterisk.
§ CHC or CDB.
□ COC or CBK.

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| CS-102 | | Shield for L-102 | Coil shield, copper, threaded, 4" dia., 3" long | | | Aluminum Goods Company | | B631270G3 |
| CS-103 | | Shield for L-103 | Same as CS-101 | | | | | |
| CS-104 | | Shield for L-104 | Same as CS-102 | | | | | |
| CS-105 | | Shield for L-105 | Same as CS-101 | | | | | |
| CS-106 | | Shield for L-106 | Same as CS-102 | | | | | |
| | | | JACKS | | | | | |
| J-101 | | Connection to headphones | Telephone jack, 4-spring, 2-circuit | CTC-49021 | RE-13A-481D | Chicago Telephone Sply. | | A180278 |
| J-102 | | Antenna jack | Concentric jack, accommodates concentric plug, Navy type-49121 | CN-49120 | | National Electric Machine Shops | | XB180315G2 |
| | | | INDUCTANCES | | | | | |
| L-101 | | 1st R.F. tuned circuit inductance for L.F. bands | Coil, R.F., comprising three universal windings on steatite ceramic tube $1\frac{1}{4}$" dia. x $4\frac{3}{4}$" long with four terminals. Each section wound with litz (10/A.W.G. No. 41 E) D.S.C. wire using two crosses per turn. Spacing $1\frac{31}{32}$" from terminal end of tube to 1st section and $\frac{1}{4}$" between sections.<br>1st Section: 810 turns, $\frac{3}{8}$" wire traverse<br>2nd Section: 910 turns, $\frac{3}{8}$" wire traverse<br>3rd Section: 1640 turns, $\frac{9}{16}$" wire traverse | | | Meissner or Sickles | | XF360151G1 |
| L-102 | | 1st R.F. tuned circuit inductance for H.F. bands 4, 5 and 6 | Coil, R.F., comprising four universal windings on steatite ceramic tube 1" dia. x $2\frac{5}{8}$" long with four terminals. Each section wound with litz (10/A.W.G. No. 41 E.) D.S.C. wire using four crosses per turn and $\frac{3}{32}$" wire traverse. Spacing $1\frac{9}{32}$" from terminal end of tube to 1st section and $\frac{1}{8}$" between sections.<br>1st Section: 130 turns<br>2nd Section: 180 turns<br>3rd Section: 195 turns<br>4th Section: 175 turns | | | Meissner or Sickles | | C360152G1 |
| L-103 | | 2nd R.F. tuned circuit inductance for L.F. bands 1, 2 and 3 | Coil, R.F., same as L-101 except each winding tapped: 1st section at 160 turns, 2nd section at 250 turns and 3rd section at 400 turns. Taps connected to three additional terminals, making total of seven terminals on coil tube | | | Meissner or Sickles | | XF360151G2 |
| L-104 | | 2nd R.F. tuned circuit inductance for H.F. bands 4, 5 and 6 | Coil, R.F., same as L-102 except 1st section tapped at 50 turns. Tap connected to additional terminal making total of five terminals on coil tube. | | | Meissner or Sickles | | C360152G2 |

## 13.1 TABLE No. 11 (Continued)
## PARTS LIST BY SYMBOL DESIGNATIONS
### Receiver Unit CMX-46155-A

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| L-105 | | Detector tuned circuit inductance and regenerative windings for L.F. bands 1, 2 and 3 | Coil, R.F. comprising five universal windings on steatite ceramic tube 1¼" dia. x 4¾" long with eleven terminals. 1st and 5th sections wound with A.W.G. No. 30 E.S.S.C. wire; 2nd, 3rd and 4th sections same as L-101 except as noted below. Spacing ¼" between 1st and 2nd sections, and 15/32" between 4th and 5th sections. 1st section: 35 turns, two crosses per turn, ⅜" wire traverse, tapped at 17 turns. 2nd section: Same as 1st section of L-101 except tapped at 200 turns. 3rd Section: Same as 2nd section of L-101 except tapped at 325 turns. 4th section: Same as 3rd section of L-101 except 1500 turns and tapped at 520 turns. 5th section: 120 turns, four crosses per turn, 3/16" wire traverse. | | | Meissner or Sickles | | XE360151G3 |
| L-106 | | Detector tuned circuit inductance and regenerative windings for H.F. bands 4, 5 and 6 | Coil, R.F., comprising five universal windings on steatite ceramic tube 1" dia. x 2⅝" long with 11 terminals. 1st section wound with A.W.G. No. 30 E.S.S.C. wire using four crosses per turn and 5/32" wire traverse; 2nd, 3rd, 4th and 5th sections same as L-102 except as noted below. Spacing 3/16" between 1st and 2nd sections. 1st Section: 20 turns, tapped at 10 and 15 turns. 2nd Section: Same as 1st section of L-102 except tapped at 50 turns. 3rd Section: Same as 2nd section of L-102 except tapped at 50 turns. 4th Section: Same as 3rd section of L-102. 5th Section: Same as 4th section of L-102 except tapped at 50 turns. | | | Meissner or Sickles | | C360152G3 |
| L-107 | | Low-pass filter between detector and 1st audio tubes to attenuate audio output at frequencies above 1200 cycles | Filter, impregnated and sealed in can, comprising four iron-core reactors connected in series, and seven capacitors five of which form the legs of the filter. From input to output side, the reactors are 22.8 h., 13.2 h., 13.2 h., and 13.2 h. respectively. The five capacitors forming the legs are, from input to output side: 1150 | | | The Magnavox Company | | XC350014G1 |

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | | mmfd., 1800 mmfd., 1300 mmfd., 1300 mmfd., and 650 mmfd. One 650 mmfd. capacitor is connected across each of the two center reactors. Voltage rating of each capacitor is 500 volts D.C. (working) | | | | | |
| L-108 | | Variable attenuator used optionally across grid circuit of 1st audio stage for audio tuning | Reactor, impregnated and sealed in can. Consists of 2500 turns A.W.G. No. 29 E. wire with taps located as follows from input to output side: 1360, 1460, 1560, 1670, 1780, 1910, 2040, 2180 and 2340 turns. Coil traverse 1¼", D.C. resistance 86 ohms. | CMX-30343 | | The Magnavox Company | | C350012 |
| L-109 | | Choke used as a filter in cathode bias supply to 1st and 2nd R.F. tubes | Reactor, iron-core, impregnated and sealed in can. Consists of 5500 turns A.W.G. No. 36 E. wire. Coil traverse $^{31}/_{32}$". Impedance 3800 ohms at 3 volts 60 cycles with 0.012 amp. D. C. D.C. resistance 220 ohms ±7½% | CMX-30245 | | The Magnavox Company | | XB350015 |
| *L-110 | | Output cable filter | R.F. choke, single layer wound on steatite core. 1000 ma. rating, inductance 5.5 microhenries, 0.85 ohms D.C. resistance. | | | Ohmite | Z-1 | A360138 |
| *L-111 | | Output cable filter | Same as L-110 | | | | | |
| L-112 | A | Output jack filter | Dual R.F. choke comprising two single layer right-hand, close-wound windings of 30 turns each. Wound together in bifilar on laminated phenolic form ½" dia. x 1⅝" long. Coil mounted between 2$^{1}/_{16}$" thick laminated phenolic terminal boards 1" wide x 1¼" long each having two terminals. | | | The Magnavox Company | | XB360139 |
| | B | Output jack filter | | | | | | |
| L-113 | | Antenna series choke for ultra high frequency signal pickup suppression | Same as L-110 | | | | | |
| | | | METERS | | | | | |
| M-101 | | Connected across output | Output meter, zero center, −10 to +5 db. ±5%, 5000 ohms ±5% D.C. resistance, 2½" dia. flush type. Reference output impedance 600 ohms; zero power level 6 milliwatts. | ▲-22152 | | Westinghouse or General Electric | | C550007G1 |
| M-102 | | Connected across heater leads | Voltmeter, AC/DC, 0 to 10 V. ±2% (15-100 cycles and 5 to 7 V. D.C.) 2½" dia. flush type. | ▲-22246 | | Westinghouse or General Electric | | C550007G2 |



* Spare parts furnished for all items preceded by an asterisk.
▲ CAY or CG.

## 13.1 TABLE No. 11 (Continued)
## PARTS LIST BY SYMBOL DESIGNATIONS
### Receiver Unit CMX-46155-A

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | | **METER SHIELDS** | | | | | |
| MS-101 | | Shield for M-102 | Meter shield, cast iron, fine grain; overall dimensions: $2\frac{19}{32}$" diameter, $2\frac{3}{4}$" long; three tapped mounting holes, 4-40 thread. | | | The Magnavox Co. | | B660054 |
| | | | **RESISTORS** | | | | | |
| *R-101 | | Resistor in parallel with gain equalizer, R-132 | 560 ohms ±10%, ½ watt, carbon, pigtail | †-63360 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G59 |
| *R-102 | | Grid bias controls on 1st and 2nd R.F. tubes SENSITIVITY | Potentiometer, 5000 ohms ±10%, 2 watts, wire wound, linear | CTC-63430 | RE-13A-492B | Chicago Tel. Supply | 25 | B220050G3 |
| *R-103 | | Part of R.F. screen voltage divider | 5100 ohms ±5%, 1 watt, carbon, pigtail | †-63291 | RE-13A-372G | Continental Carbon or International Resistance | | B230062G176 |
| *R-104 | | Part of R.F. screen voltage divider | 10,000 ohms ±10%, 1 watt, carbon, pigtail | †-63288 | RE-13A-372G | Continental Carbon or International Resistance | | B230062G74 |
| *R-105 | | Cathode bias resistor on 1st R.F. tube | 510 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G152 |
| *R-106 | | Screen filter on 1st R.F. tube | 10,000 ohms ±10%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G74 |
| *R-107 | | Plate filter on 1st R.F. tube | Same as R-106 | †-63360 | | | | |
| *R-108 | | Grid resistor on 2nd R.F. tube | 4.7 megohm ±10%, ½ watt, carbon, pigtail | †-63360 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G106 |
| *R-109 | | Cathode bias resistor on 2nd R.F. tube | 270 ohms ±10%, ½ watt, carbon, pigtail | †-63360 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G55 |
| *R-110 | | Screen filter on 2nd R.F. tube | Same as R-106 | †-63360 | | | | |
| *R-111 | | Plate filter on 2nd R.F. tube | Same as R-106 | †-63360 | | | | |
| *R-112 | | Grid leak on detector tube | Same as R-108 | †-63360 | | | | |
| *R-113 | | Screen filter on detector tube | Same as R-106 | †-63360 | | | | |
| *R-114 | | Plate load on detector tube | 100,000 ohms ±10%, ½ watt, carbon, pigtail | †-63360 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G86 |
| *R-115 | | Plate filter on detector tube | Same as R-106 | †-63360 | | | | |
| *R-116 | | Part of detector screen voltage divider | 24,000 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G192 |
| *R-117 | | Part of detector screen voltage divider | 51,000 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G200 |

* Spare parts furnished for all items preceded by an asterisk.
† CCC or CIR.

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| *R-118 | | Plate filter on 2nd R.F. and detector tubes | Same as R-104 | †-63288 | | | | |
| *R-119 | | Grid filter on 1st audio tube | 1 megohm ±10%, ½ watt, carbon, pigtail | †-63360 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G98 |
| *R-120 | | Grid resistor on 1st audio tube | Same as R-114 | †-63360 | | | | |
| *R-121 | | Plate load on 1st audio tube | Same as R-114 | †-63360 | | | | |
| *R-122 | | Grid resistor on output tube | Same as R-119 | †-63360 | | | | |
| *R-123 | | Cathode bias resistor on 1st audio tube | 1000 ohms ±10%, ½ watt, carbon, pigtail | †-63360 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G62 |
| *R-124 | | Screen filter on 1st audio tube | 390,000 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G221 |
| *R-125 | | Plate filter on 1st audio tube | 20,000 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G190 |
| *R-126 | | Screen and plate filter on output tube | 4700 ohms ±10%, 1 watt, carbon, pigtail | †-63288 | RE-13A-372G | Continental Carbon or International Resistance | | B230062G70 |
| *R-127 | | Cathode bias resistor on output tube | 620 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G154 |
| *R-128 | | Part of output meter multiplier | 12,000 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G185 |
| *R-129 | | Part of output meter multiplier | 11,000 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G184 |
| *R-130 | | Part of output meter multiplier | Same as R-129 | †-63355 | | | | |
| *R-131 | | Part of output meter multiplier | 3900 ohms ±5%, ½ watt, carbon, pigtail | †-63355 | RE-13A-372G | Continental Carbon or International Resistance | | B230063G173 |
| *R-132 | | Gain equalizer ganged with main tuning control | Potentiometer, 1000 ohms ±10%, 2 watt, wire wound, continuously rotatable | CWC-63427 63247 | | Wirt Company | | B220048 |
| *R-133 | | Detector tube screen voltage control REGENERATION | Potentiometer, 25,000 ohms ±10%, 2 watt, wire wound, linear | ‡-63[illegible] | RE-13A-492B | Wirt or Clarostat | | B220050G1 |
| *R-134 | | Grid bias control on A.V.C. tube AVC LEVEL | Potentiometer, 20,000 ohms ±10%, 2 watt, wire wound, first quarter turn clockwise, 1000 ohms | ‡-63429 | RE-13A-492B | Wirt or Clarostat | | B220050G2 |
| | | | SWITCHES | | | | | |
| *S-101 | | Connects AUDIO TUNING variable attenuator L-108 across grid circuit of 1st audio tube | Toggle switch, S.P.S.T., 3 amp. 250 V. | CAE-24000 | RE-24AA-118A | Cutler-Hammer | 8280 | C160080G1 |
| *S-102 | | Connects either high or low frequency AUDIO TUNING variable attenuator across grid circuit of 1st audio tube | Toggle switch, D.P.D.T., 3 amp. 250 V. | CHH-24003 | RE-24AA-118A | Arrow, Hart & Hegeman | 8363 | C160037G11 |

* Spare parts furnished for all items preceded by an asterisk.
† CCC or CIR.
‡ CWC or CMC.

## 13.1 TABLE No. 11 (Continued)
## PARTS LIST BY SYMBOL DESIGNATIONS
### Receiver Unit CMX-46155-A

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| S-103 | | Used to change taps on variable attenuator | Rotary switch, single deck, ten-position | | | Chicago Tel. Supply | W-228-110 | B160088G2 |
| *S-104 | | Connects A.V.C. transformer (T-102) across plate circuit of output tube | Same as S-101 | CAE-24000 | | | | |
| S-105 | | Used to change resistance in series with output DB meter | Rotary switch, single deck, five-position | | | Chicago Tel. Supply | W-228-15 | C160088G1 |
| *S-106 | | Breaks +A and +B supply on battery-operated equipment | Toggle switch, D.P.S.T., 3 amp. 250 V. | CAE-24001 | RE-24AA-118A | Cutler-Hammer | 8360 | C160080G3 |
| S-107 | | 1st R.F. circuit band switch section | Switch section, 12 silver contacts on steatite plate | | | The Magnavox Company | | XC160086G1 |
| S-108 | | 1st R.F. circuit band switch section | Same as S-107 except for contact wiring | | | The Magnavox Company | | XC160086G2 |
| S-109 | | 2nd R.F. circuit band switch section | Same as S-107 except for contact wiring | | | The Magnavox Company | | XC160086G3 |
| S-110 | | 2nd R.F. circuit band switch section | Same as S-107 except for contact wiring | | | The Magnavox Company | | XC160086G4 |
| S-111 | | Detector circuit band switch section | Same as S-107 except for contact wiring | | | The Magnavox Company | | XC160086G5 |
| S-112 | | Detector circuit band switch section | Same as S-107 except for contact wiring | | | The Magnavox Company | | XC160086G6 |
| S-113 | | Detector circuit band switch section | Same as S-107 except for contact wiring | | | The Magnavox Company | | XC160086G7 |
| S-114 | | Connects detector cathode to ground to stop oscillation | OSC. TEST push button, spring contact, isolantite base | | | The Magnavox Company | | XA160085 |
| | | | TRANSFORMERS | | | | | |
| *T-101 | | Couples plate circuit of output tube to telephone jack; secondary mid-tapped to ground; 600 ohms output impedance | Output transformer, D.C. resistance: Primary, 427 ohms; Secondary, 41.7 ohms; impregnated and sealed in a can | CMX-30242A | | The Magnavox Company | | XB330015 |
| *T-102 | | Used optionally across plate circuit of output tube to feed grid of A.V.C. tube | A.V.C. transformer, D.C. resistance: Primary, 57 ohms; Secondary, 3540 ohms; impregnated and sealed in a can | CMX-30244 | | The Magnavox Company | | B320012 |
| | | | TUBE SHIELDS | | | | | |
| TS-101 | A | Shield for V-101 | Tube shield body, aluminum, chimney-type $1\frac{37}{64}$" dia., $3\frac{27}{32}$" long | | | Aluminum Goods Mfg. Co. | | A631527 |
| | B | | Tube shield cap, aluminum, $1\frac{5}{8}$" dia., $2\frac{1}{16}$" long | | | Aluminum Goods Mfg. Co. | | A631528 |
| TS-102 | | Shield for V-102 | Same as TS-101 | | | | | |

* Spare parts furnished for all items preceded by an asterisk.

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| TS-103 | | Shield for V-103 | Same as TS-101 | | | | | |
| TS-104 | | Shield for V-104 | Same as TS-101 | | | | | |
| TS-105 | | Shield for V-106 | Same as TS-101 | | | | | |
| | | | VACUUM TUBES | | | | | |
| *V-101 | | 1st R.F. amplifier | Triple grid supercontrol amplifier tube | 6D6 | RE-13A-600A | R.C.A. (Radiotron) | 6D6 | |
| *V-102 | | 2nd R.F. amplifier | Same as V-101 | 6D6 | | | | |
| *V-103 | | Detector | Same as V-101 | 6D6 | | | | |
| *V-104 | | 1st Audio Amplifier | Same as V-101 | 6D6 | | | | |
| *V-105 | | 2nd Audio Amplifier | Power amplifier pentode tube | 41 | RE-13A-600A | R.C.A. (Radiotron) | 41 | |
| *V-106 | | A.V.C. | Same as V-105 | 41 | | | | |
| | | | SOCKETS | | | | | |
| *X-101 | | Receptacle for 1st R.F. tube | Six-prong wafer-type, ceramic base, $1\frac{27}{32}$" hole centers | CEJ-49364 | | E. F. Johnson Co. | | A180274 |
| *X-102 | | Receptacle for 2nd R.F. tube | Same as X-101 | CEJ-49364 | | | | |
| *X-103 | | Receptacle for detector tube | Same as X-101 | CEJ-49364 | | | | |
| *X-104 | | Receptacle for 1st audio tube | Six-prong, wafer-type, phenolic base, $1\frac{27}{32}$" hole centers | O-49308 | RE-38AA-140A | Ucinite or American Radio Hardware | | A180275 |
| *X-105 | | Receptacle for 2nd audio tube | Same as X-104 | O-49308 | | | | |
| *X-106 | | Receptacle for A.V.C. tube | Same as X-104 | O-49308 | | | | |

## Power Unit CMX-20131-A

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | CAPACITORS | | | | | |
| *C-201 | | R.F. by-pass on A.C. input power leads | Same as C-122 | | | | | |
| *C-202 | | R.F. by-pass on A.C. input power leads | Same as C-122 | | | | | |
| *C-203 | | R.F. by-pass on A.C. input power leads | Same as C-122 | | | | | |
| *C-204 | | Main voltage filter | Paper, oil-filled pack containing: 3/3/3 mfd. ±10%, 400 V. D.C. (working) | CBV-48540-A10 | RE-48AA-137A | John E. Fast Co. | | B250100 |
| | | | FUSES | | | | | |
| *F-201 | | Used in A.C. input line | Fuse, glass cartridge type, 3 amp. 250 V. | | 17-F-2f | Littelfuse | 1043 | A180157G7 |
| *F-202 | | Used in A.C. input line | Same as F-201 | | | | | |

* Spare parts furnished for all items preceded by an asterisk.
O CUF or CMH.

## 13.1 TABLE No. 11 (Continued)
## PARTS LIST BY SYMBOL DESIGNATIONS
### Power Unit CMX-20131-A

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | | **INDUCTANCES** | | | | | |
| L-201 | | Used in series with A.C. input | R.F. choke, 69 turns A.W.G. No. 18 E. copper wire wound on 1" dia. phenolic tube | | | The Magnavox Company | | XB360147G1 |
| L-202 | | Used in series with A.C. input | Same as L-201 | | | | | |
| L-203 | | Line filter on A.C. input | R.F. filter, two iron-core reactors and two capacitors, impregnated and sealed in a can. Reactors .073 and .084 ohms resistance (approx.), 2 to 12 millihenries inductance. Capacitors 1.0 mfd. ±10%, 300 V. D.C. (working) | CMX-30248 | | The Magnavox Company | | XC360154 |
| L-204 | | Used as 1st section of main filter on D.C. output; end section in series with middle filter capacitor acts as a tuned low impedance to ripple frequency | Filter reactor, tapped, iron core, impregnated and sealed, 210 ohms ±7.5% D.C. resistance, 5200 ohms at 3 volts, 60 cycles, .08 amp. D.C.; three leads | CMX-30247 | | The Magnavox Company | | XB350016G2 |
| L-205 | | Used as 2nd section of main filter on D.C. output | Same as L-204, except untapped and has two leads | CMX-30246 | | The Magnavox Company | | XB350016G1 |
| | | | **RESISTORS** | | | | | |
| *R-201 | | Drop resistor in series with current-regulator lamp across A.C. input | 80 ohms ±10%, 200 watts, vitreous enamel, ferrule type, 9⅝" long | ▲-63184 | | Ohmite or Ward-Leonard | | B240022G1 |
| *R-202 | | Bleeder across H.V. output | 20,000 ohms ±5%, 3 watts, carbon, pigtail | CCC-63426 | RE-13A-372G | Continental Carbon Co. | | B230077G190 |
| *R-203 | | Voltage divider in series with voltage-regulator tube across H.V. output to supply 90 volts D.C. | 6200 ohms ±5%, 2 watts, carbon, pigtail | CCC-63426 | | | | B230061G178 |
| *R-204 | | Used in parallel with R-203 | Same as R-203 | CCC-63426 | | | | |
| | | | **SWITCHES** | | | | | |
| *S-201 | | Used to break both sides of A.C. input | Same as S-106 | CAE-24001 | | | | |
| *S-202 | | Used to disconnect current-regulated A.C. supply from power transformer primary tap and to connect A.C. supply directly across full primary winding. This switch to be thrown only with current-regulator tube (V-201) removed. | Same as S-102 | CHH-24003 | | | | |

* Spare parts furnished for all items preceded by an asterisk.
▲ COM or CAO.

| Symbol Desig. | Sub | Function | Description | Navy Type No. | Navy Spec. or Dwg. | Manufacturer | Mfg. No. | Magnavox Drawing No. |
|---|---|---|---|---|---|---|---|---|
| | | | **TRANSFORMERS** | | | | | |
| T-201 | | Main high and low voltage A.C. supply | Power transformer, impregnated and sealed in a can, 15 leads. Primary No. 1-62, 65, 68 V.; D.C. resistance 2 ohms. Primary No. 1 and No. 2—110, 115, 120 V.; D.C. resistance 5.03 ohms. Plate winding — 500 V. mid-tapped; D.C. resistance 250 ohms. Rectifier filament — 5 V., Receiver tube filaments — 7.16 V. mid-tapped. All voltages no load 60 cycles. Primary No. 1 for use with current-regulator tube only. | CMX-30444 | | The Magnavox Company | | B300016 |
| | | | **VACUUM TUBES** | | | | | |
| *V-201 | | Current regulator | Current-regulator tube | CRC-876 | RE-13A-600A | R.C.A. (Radiotron) | 876 | |
| *V-202 | | Rectifier | Full-wave rectifier tube | CRC-5Z3 | RE-13A-600A | R.C.A. (Radiotron) | 5Z3 | |
| *V-203 | | Voltage regulator | Voltage-regulator tube | CRC-874 | RE-13A-600A | R.C.A. (Radiotron) | 874 | |
| | | | **SOCKETS** | | | | | |
| X-201 | | Receptacle for current-regulator tube | Mogul size, encased in porcelain | | | Bryant Electric Co. | 4062 | A180250 |
| *X-202 | | Receptacle for rectifier tube | 4-prong, wafer-type, phenolic base with shock-mounting end supports | ✪-49311A | | Ucinite and American Radio Hardware | | XA180284 |
| *X-203 | | Receptacle for voltage-regulator tube | Same as X-202 | ✪-49311A | | | | |

## Control Unit CMX-27073-A

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **FUSES** | | | | | |
| *F-301 | | Used in input line | Fuse, glass cartridge type, 5 amp. 250 V. | | 17-F-2f | Littelfuse | | A180157G9 |
| *F-302 | | Used in input line | Same as F-301 | | | | | |
| | | | **JACKS** | | | | | |
| J-301 | | Output jack | Same as J-101 | CTC-49021 | | | | |
| J-302 | | Output jack | Same as J-101 | CTC-49021 | | | | |
| | | | **SWITCHES** | | | | | |
| *S-301 | | Power switch | Same as S-106 | CAE-24001 | | | | |
| *S-302 | | Power switch | Same as S-106 | CAE-24001 | | | | |
| S-303 | | Used to connect output of either receiver unit or of both to telephone jacks | Mixer switch, low capacity, 4-pole 3-position | | | Stromberg-Carlson Telephone Mfg. Co. | 172A (modified) | A160084 |

* Spare parts furnished for all items preceded by an asterisk.
✪ CUF or CMH.

## 13.2 TABLE No. 12

## PARTS LIST BY NAVY TYPE NUMBERS

(The quantities listed do not include the spare parts)

CMX-46155-A Receiver Unit for Model RAK-8

CMX-20131-A Power Unit for Model RAK-8

CMX-23073-A Control Unit for Optional Use with Models RAK-8 and RAL-8

| Quantity | Navy Type No. | Symbol Designations | Description |
|---|---|---|---|
| | | **MISCELLANEOUS (CLASS 10)** | |
| 3 | | CS-101, CS-103, CS-105 | Coil shield, copper, 4" dia., 5¼" long |
| 3 | | CS-102, CS-104, CS-106 | Coil shield, copper, 4" dia., 3" long |
| 5 | | TS-101, TS-102, TS-103, TS-104, TS-105 | Tube shield and cap, aluminum |
| | | **INDICATING INSTRUMENTS (CLASS 22)** | |
| 1 | – 22152 | M-101 | |
| 1 | – 22246 | M-102 | |
| | | **SWITCHES (CLASS 24)** | |
| 2 | | S-101, S-104 | |
| 4 | – 24000 | S-106, S-201, S-301, S-302 | |
| 2 | – 24003 | S-102, S-202 | |
| 1 | | S-103 | |
| 1 | | S-105 | |
| 1 | | S-107 | Switch segment, 12 contacts |
| 1 | | S-108 | Switch segment, 12 contacts |
| 1 | | S-109 | Switch segment, 12 contacts |
| 1 | | S-110 | Switch segment, 12 contacts |
| 1 | | S-111 | Switch segment, 12 contacts |
| 1 | | S-112 | Switch segment, 12 contacts |
| 1 | | S-113 | Switch segment, 12 contacts |
| 1 | | S-114 | Push-button, 3 contacts |
| 1 | | S-303 | Low-cap., 4-pole, 3-pos. switch |
| | | **FUSES, PROTECTIVE DEVICES, ETC. (CLASS 28)** | |
| 2 | | F-201, F-202 | Fuse, 3 amps., 250 volts |
| 2 | | F-301, F-302 | Fuse, 5 amps., 250 volts |
| | | **A-F TRANSFORMERS AND REACTORS (CLASS 30)** | |
| 1 | – 30242A | T-101 | |
| 1 | – 30243 | L-109 | |
| 1 | – 30244 | T-102 | |
| 1 | – 30246 | L-205 | |
| 1 | – 30247 | L-204 | |
| 1 | – 30248 | L-203 | |
| 1 | – 30343 | L-108 | |
| 1 | – 30444 | T-201 | |
| | | **VACUUM TUBES AND V.T. SOCKETS (CLASS 38)** | |
| 2 | – 41 | V-105, V-106 | |
| 1 | – 874 | V-203 | |
| 1 | – 876 | V-201 | |
| 3 | – 49308 | X-104, X-105, X-106 | |
| 2 | – 49311A | X-202, X-203 | |
| 3 | – 49364 | X-101, X-102, X-103 | |
| 1 | – 5Z3 | V-202 | |
| 4 | – 6D6 | V-101, V-102, V-103, V-104 | |
| 1 | | X-201 | Mogul-size ceramic socket |
| | | **R-F INDUCTANCES (CLASS 47)** | |
| 1 | | L-101 | Antenna coil |
| 1 | | L-102 | Antenna coil |
| 1 | | L-103 | RF coil |
| 1 | | L-104 | RF coil |
| 1 | | L-105 | Detector coil |
| 1 | | L-106 | Detector coil |
| 3 | | L-110, 111, 113 | RF choke |
| 1 | | L-112A & B | RF choke |
| 2 | | L-201, L-202 | RF choke |
| | | **CAPACITORS (CLASS 48)** | |
| 5 | | C-122, C-133, C-201, C-202, C-203 | Mica, .01 mfd., 600 V. D.C. |
| 1 | – 48540A | C-204 | Paper, 3/3/3 mfd., 400 V. D.C. |
| 1 | | C-129 | Mica, .002 mfd., 1200 V. D.C. |
| 1 | | C-123 | Mica, 100 mmf., 500 V. D.C. |

## 13.2 TABLE No. 12 (Continued)
## PARTS LIST BY NAVY TYPE NUMBERS

| Quantity | Navy Type No. | Symbol Designations | Description |
|---|---|---|---|
| | | CAPACITORS (CLASS 48)—Continued | |
| 16 | –48553-10 | C-116, C-117, C-119, C-121, C-124, C-125, C-126, C-127, C-130, C-131, C-132, C-134, C-135, C-136, C-137, C-138 | Paper, 1.0 mfd., 250 V. D.C. |
| 1 | –48554-15 | C-114 | Paper, 0.5—0.5 mfd., 250 V. D.C. |
| 4 | –48556-15 | C-108, C-113, C-115, C-120 | Paper, 0.5—0.5 mfd., 250 V. D.C. |
| 1 | | C-128 | Mica, .001 mfd., 2500 V. D.C. |
| 1 | | C-101 | Mica, 300 mmf., 500 V. D.C. |
| 2 | | C-112, C-118 | Mica, 510 mmf., 2500 V. D.C. |
| 1 | | C-145 | Mica, 910 mmf., 500 V. D.C. |
| 1 | | C-103 | Mica, 820 mmf., 500 V. D.C. |
| 1 | | C-104 | Mica, 62 mmf., 500 V. D.C. |
| 1 | | C-139 | Silver mica, 45.4 mmf., 500 V. D.C. |
| 1 | | C-102 | Mica, 1200 mmf., 500 V. D.C. |
| 1 | –48575 | C-111 | Variable, 5.3 to 27 mmf. |
| 2 | –48577 | C-107, C-140 | Variable, 6 to 50 mmf. |
| 1 | –48578 | C-106 | Variable, 6 to 60 mmf. |
| 2 | –48579 | C-141, C-142 | Variable, 7.5 to 80 mmf. |
| 2 | –48580 | C-109, C-110 | Variable, 6 to 80.4 mmf. |
| 2 | –48581 | C-143, C-144 | Variable, 9 to 125 mmf. |
| 1 | –48806-10 | C-146 | Paper, .025 mfd., 600 V. D.C. |
| 1 | –48807-10 | C-147 | Paper, .075 mfd., 600 V. D.C. |
| 4 | | C-148, 149, 150, 151 | Mica, .01 mfd., 300 V. D.C. |
| 1 | | C-105 | Variable air capacitor, 3-gang, 26.3 to 467 mmf. each |
| | | JACKS, PLUGS, PHONES, ETC. (CLASS 49) | |
| 3 | —49021 | J-101, J-301, J-302 | 4 spring, 2 circuit jack |
| | | FILTERS (CLASS 53) | |
| 1 | –53031 | L-107 | Low-pass filter |
| | | RESISTORS, POTENTIOMETERS, ETC. (CLASS 63) | |
| 1 | –63184 | R-201 | 80 ohms |
| 1 | –63247 | R-133 | 25,000 ohms |
| 1 | –63288 | R-126 | 4700 ohms |
| 2 | –63288 | R-104, R-118 | 10,000 ohms |
| 1 | –63291 | R-103 | 5100 ohms |
| 1 | –63355 | R-105 | 510 ohms |
| 1 | –63355 | R-127 | 620 ohms |
| 1 | –63355 | R-131 | 3900 ohms |
| 2 | –63355 | R-129, R-130 | 11,000 ohms |
| 1 | –63355 | R-128 | 12,000 ohms |
| 1 | –63355 | R-125 | 20,000 ohms |
| 1 | –63355 | R-116 | 24,000 ohms |
| 1 | –63355 | R-117 | 51,000 ohms |
| 1 | –63355 | R-124 | 390,000 ohms |
| 1 | –63360 | R-109 | 270 ohms |
| 1 | –63360 | R-101 | 560 ohms |
| 1 | –63360 | R-123 | 1000 ohms |
| 6 | –63360 | R-106, R-107, R-110, R-111, R-113, R-115 | 10,000 ohms |
| 3 | –63360 | R-114, R-120, R-121 | 100,000 ohms |
| 2 | –63360 | R-119, R-122 | 1 megohm |
| 2 | –63360 | R-108, R-112 | 4.7 megohms |
| 2 | –63426 | R-203, R-204 | 6200 ohms |
| 1 | | R-202 | 20,000 ohms |
| 1 | –63427 | R-132 | 1000 ohms |
| 1 | –63429 | R-134 | 20,000 ohms |
| 1 | –63430 | R-102 | 5000 ohms |

## 13.3 TABLE No. 13
## SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS
### CMX-46155-A Receiver Unit for Model RAK-8
### CMX-20131-A Power Unit for Model RAK-8
### Contract NXss-21827—Dated: 14 January 1943

| Quan. | Navy Type No. | Symbol Designations | Description | Magnavox Drawing No. |
|---|---|---|---|---|
| | | | CMX-46155-A RADIO RECEIVER | |
| | | | Spare Parts Box | D990132 |
| 4 | 6D6 | V-101, V-102, V-103, V-104 | Vacuum Tube, Type 6D6 | |
| 2 | 41 | V-105, V-106 | Vacuum Tube, Type 41 | |
| 1 | CMX-10012 | | Spanner Wrench | XA631655 |
| 1 | CAE-24000 | S-101, S-104 | Toggle Switch, S.P.S.T., 3 amp., 250 V. | C160080G1 |
| 1 | CAE-24001 | S-106, S-201 | Toggle Switch, D.P.S.T., 3 amp., 250 V. | C160080G3 |
| 1 | CHH-24003 | S-102, S-202 | Toggle Switch, D.P.D.T., 3 amp., 250 V. | C160037G11 |
| 1 | CMX-30242A | T-101 | Output Transformer, D.C. resistance: primary 427 ohms, secondary 41.7 ohms | XB330015 |
| 1 | CMX-30244 | T-102 | A.V.C. Transformer, D.C. resistance: primary 57 ohms, secondary 3540 ohms | B320012 |
| 1 | CMX-30343 | L-108 | Reactor, audio attenuator, D.C. resistance: 86 ohms | C350012 |
| 8 | CBV-48553-10 | C-116, C-117, C-119, C-121, C-124, C-125, C-126, C-127, C-130, C-131, C-132, C-134, C-135, C-136, C-137, C-138 | Capacitor, paper, oil-filled, 1.0 mfd. ±10%, 250 V. D.C. (working) | B250101G3 |
| 1 | CBV-48554-15 | C-114 | Capacitor, paper, oil-filled, 2-section .5-.5 mfd. ±15%, 250 V. D.C. (working) | B250101G4 |
| 2 | CBV-48556-15 | C-108, C-113, C-115, C-120 | Capacitor, paper, oil-filled, 2-section .5-.5 mfd. ±15%, 250 V. D.C. (working) | B250102G2 |
| 1 | § -48575 | C-111 | Capacitor, variable, 5.3 to 27 mmf., 4 plate | B260036G1 |
| 1 | § -48577 | C-107, C-140 | Capacitor, variable, 6 to 50 mmf., 7 plate | B260036G3 |
| 1 | § -48578 | C-106 | Capacitor, variable, 6 to 60 mmf., 8 plate | B260036G4 |
| 1 | § -48579 | C-141, C-142 | Capacitor, variable, 7.5 to 80 mmf., 11 plate | B260036G5 |
| 1 | □ -48580 | C-109, C-110 | Capacitor, variable, 6 to 80.4 mmf., 15 plate | B260035G1 |
| 1 | □ -48581 | C-143, C-144 | Capacitor, variable, 9 to 125 mmf., 23 pate | B260035G2 |
| 1 | CBV-48806-10 | C-146 | Capacitor, paper, oil-filled, .025 mfd. ±10%, 600 V. D.C. (working) | B250101G1 |
| 1 | CBV-48807-10 | C-147 | Capacitor, paper, oil-filled, .075 mfd. ±10%, 600 V. D.C. (working) | B250101G2 |
| 1 | | C-112, C-118 | Capacitor, molded mica, 510 mmf. ±5%, 500 V. D.C. (working) | C250107G1064 |
| 2 | | C-148, C-149, C-150, C-151 | Capacitor, molded mica, .01 mfd. ±10%, 300 V. D.C. (working) | C250111G1046 |
| 1 | | C-123 | Capacitor, molded mica, 100 mmf. ±5%, 500 V. D.C. (working) | C250107G1047 |
| 1 | | C-122, C-133, C-201, C-202, C-203 | Capacitor, molded mica, .01 mfd. ±10%, 600 V. D.C. (working) | C250106G1148 |
| 1 | | C-128 | Capacitor, molded mica, .001 mfd. ±10%, 2500 V. D.C. (working) | C250106G1136 |
| 1 | | C-129 | Capacitor, molded mica, .002 mfd. ±5%, 1200 V. D.C. (working) | C250106G1099 |
| 1 | | C-145 | Capacitor, molded mica, 910 mmf. ±5%, 500 V. D.C. (working) | C250109G1037 |
| 1 | | C-102 | Capacitor, molded mica, 1200 mmf. ±5%, 500 V. D.C. (working) | C250109G1040 |
| 1 | | C-103 | Capacitor, molded mica, 820 mmf. ±5%, 500 V. D.C. (working) | C250109G1036 |
| 1 | | C-104 | Capacitor, molded mica, 62 mmf. ±2%, 500 V. D.C. (working) | C250107G2003 |
| 1 | | C-139 | Capacitor, silver mica, 45.4 mmf. ±2%, 500 V. D.C. (working) | B250085G23 |
| 1 | | C-101 | Capacitor, molded mica, 300 mmf. ±10%, 500 V. D.C. (working) | B250073G145 |
| 2 | CUF-49308 | X-104, X-105, X-106 | Tube Socket, 6-prong, wafer type, phenolic base | A180275 |
| 2 | CEJ-49364 | X-101, X-102, X-103 | Tube Socket, 6-prong, wafer type, ceramic base | A180274 |
| 2 | | L-110, L-111, L-113 | R. F. Choke, inductance: 5.5 microhenries, 0.85 ohms D.C. resistance, 1000 MA. | A360138 |
| 1 | ‡ -63247 | R-133 | Potentiometer, 25,000 ohms ±10%, 2 watt, wire wound, linear | B220050G1 |
| 1 | † -63288 | R-126 | Resistor, 4700 ohms ±10%, 1 watt, carbon, pigtail | B230062G70 |
| 1 | † -63288 | R-104, R-118 | Resistor, 10,000 ohms ±10%, 1 watt, carbon, pigtail | B230062G74 |
| 1 | † -63291 | R-103 | Resistor, 5100 ohms ±5%, 1 watt, carbon, pigtail | B230062G176 |
| 1 | † -63355 | R-105 | Resistor, 510 ohms ±5%, ½ watt, carbon, pigtail | B230063G152 |
| 1 | † -63355 | R-127 | Resistor, 620 ohms ±5%, ½ watt, carbon, pigtail | B230063G154 |
| 1 | † -63355 | R-131 | Resistor, 3900 ohms ±5%, ½ watt, carbon, pigtail | B230063G173 |
| 1 | † -63355 | R-129, R-130 | Resistor, 11,000 ohms ±5%, ½ watt, carbon, pigtail | B230063G184 |
| 1 | † -63355 | R-128 | Resistor, 12,000 ohms ±5%, ½ watt, carbon, pigtail | B230063G185 |
| 1 | † -63355 | R-125 | Resistor, 20,000 ohms ±5%, ½ watt, carbon, pigtail | B230063G190 |
| 1 | † -63355 | R-116 | Resistor, 24,000 ohms ±5%, ½ watt, carbon, pigtail | B230063G192 |
| 1 | † -63355 | R-117 | Resistor, 51,000 ohms ±5%, ½ watt, carbon, pigtail | B230063G200 |
| 1 | † -63355 | R-124 | Resistor, 390,000 ohms ±5%, ½ watt, carbon, pigtail | B230063G221 |
| 1 | † -63360 | R-109 | Resistor, 270 ohms ±10%, ½ watt, carbon, pigtail | B230063G55 |
| 1 | † -63360 | R-101 | Resistor, 560 ohms ±10%, ½ watt, carbon, pigtail | B230063G59 |
| 1 | † -63360 | R-123 | Resistor, 1000 ohms ±10%, ½ watt, carbon, pigtail | B230063G62 |
| 3 | † -63360 | R-106, R-107, R-110, R-111, R-113, R-115 | Resistor, 10,000 ohms ±10%, ½ watt, carbon, pigtail | B230063G74 |
| 2 | † -63360 | R-114, R-120, R-121 | Resistor, 100,000 ohms ±10%, ½ watt, carbon, pigtail | B230063G86 |
| 1 | † -63360 | R-119, R-122 | Resistor, 1 megohm ±10%, ½ watt, carbon, pigtail | B230063G98 |
| 1 | † -63360 | R-108, R-112 | Resistor, 4.7 megohm ±10%, ½ watt, carbon, pigtail | B230063G106 |
| 1 | CWC-63427 | R-132 | Potentiometer, 1000 ohms ±10%, 2 watt, wire wound, continuously rotatable | B220048 |
| 1 | ‡ -63429 | R-134 | Potentiometer, 20,000 ohms ±10%, 2 watt, wire wound, first quarter turn clockwise, 1,000 ohms | B220050G2 |
| 1 | CTC-63430 | R-102 | Potentiometer, 5000 ohms ±10%, 2 watt, wire wound, linear | B220050G3 |

‡ CWC, CMC. † CIR, CCC. § CHC, CDB. □ COC, CBK.

## 13.3 TABLE No. 13 (Continued)

## SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS (Continued)

CMX-46155-A Receiver Unit for Model RAK-8

CMX-20131-A Power Unit for Model RAK-8

Contract NXss-21827—Dated: 14 January 1943

| Quan. | Navy Type No. | Symbol Designations | Description | Magnavox Drawing No. |
|---|---|---|---|---|
| | | | CMX-20131-A POWER UNIT | |
| 1 | 5Z3 | V-202 | Vacuum Tube, Type 5Z3, full wave rectifier | |
| 1 | 874 | V-203 | Vacuum Tube, Type 874, voltage regulator | |
| 1 | 876 | V-201 | Vacuum Tube, Type 876, current regulator | |
| 1 | CAF-24001 | S-106, S-201 | Toggle Switch, D.P.S.T., 3 amp., 250 V. | C160080G3 |
| 1 | CHH-24003 | S-102, S-202 | Toggle Switch, D.P.D.T., 3 amp., 250 V. | C160037G11 |
| 1 | | F-201, F-202 | Fuse, 3 amp., 250 V., cartridge type | A180157G7 |
| 1 | CBV-48540A | C-204 | Capacitor, paper, oil-filled, 3-3-3 mfd. +20%, 400 V. D.C. (working) | B250100 |
| 1 | CUF-49311A | X-202, X-203 | Tube Socket, 4 prong, wafer type, phenolic base, in shock mounting | XA180284 |
| 2 | | C-122, C-133, C-201, C-202, C-203 | Capacitor, molded mica, .01 mfd. ±10%, 600 V. D.C. (working) | C250106G1148 |
| 1 | ▲ -63184 | R-201 | Resistor, 80 ohms ±10%, 200 watt, vitreous enamel | B240022G1 |
| 1 | CCC-63426 | R-203, R-204 | Resistor, 6200 ohms ±5%, 2 watt, carbon, pigtail | B230061G178 |
| 1 | | R-202 | Resistor, 20,000 ohms ±5%, 3 watt, carbon, pigtail | B230077G190 |

▲ CAO, COM.

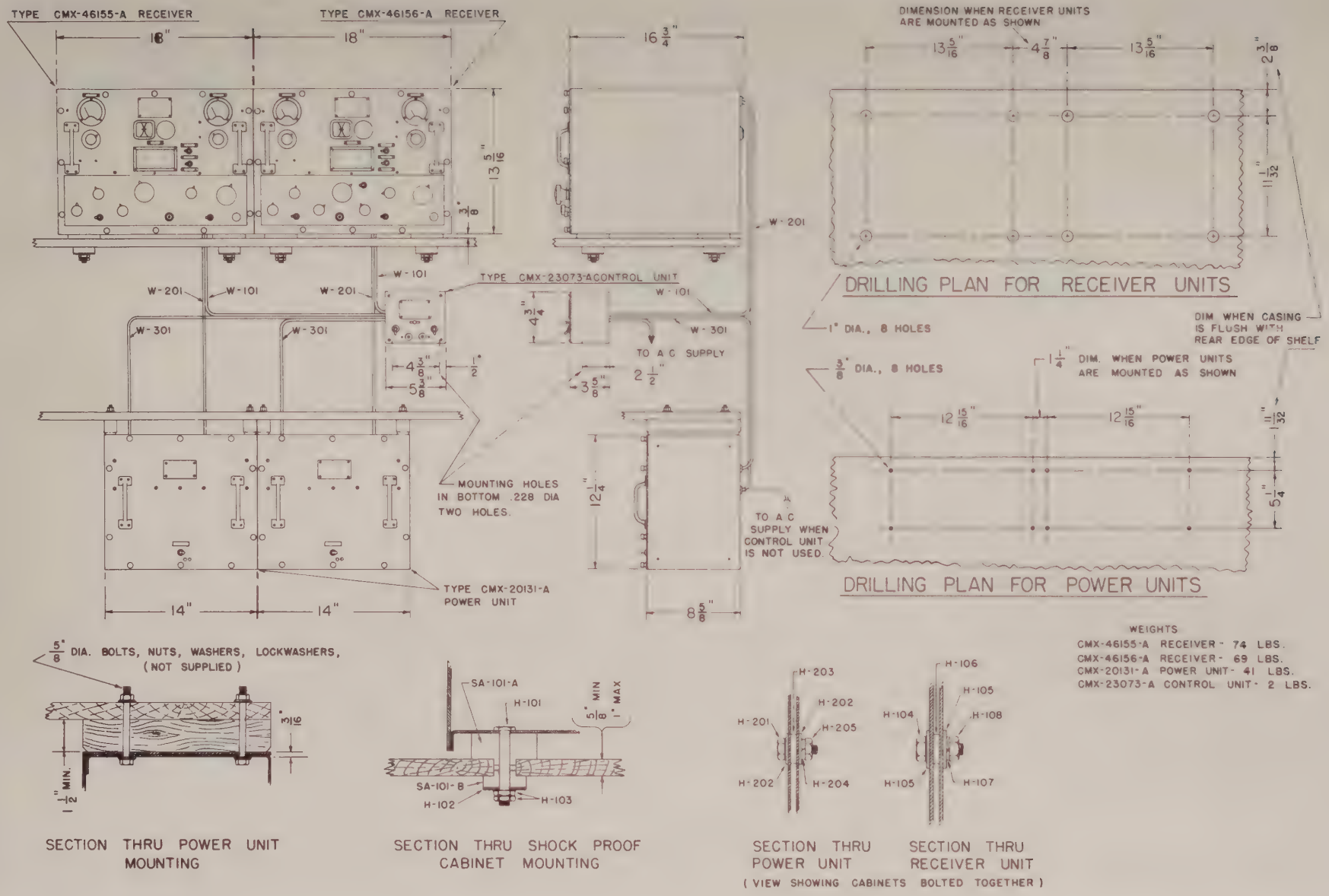



*Figure 14—Outline and Installation*

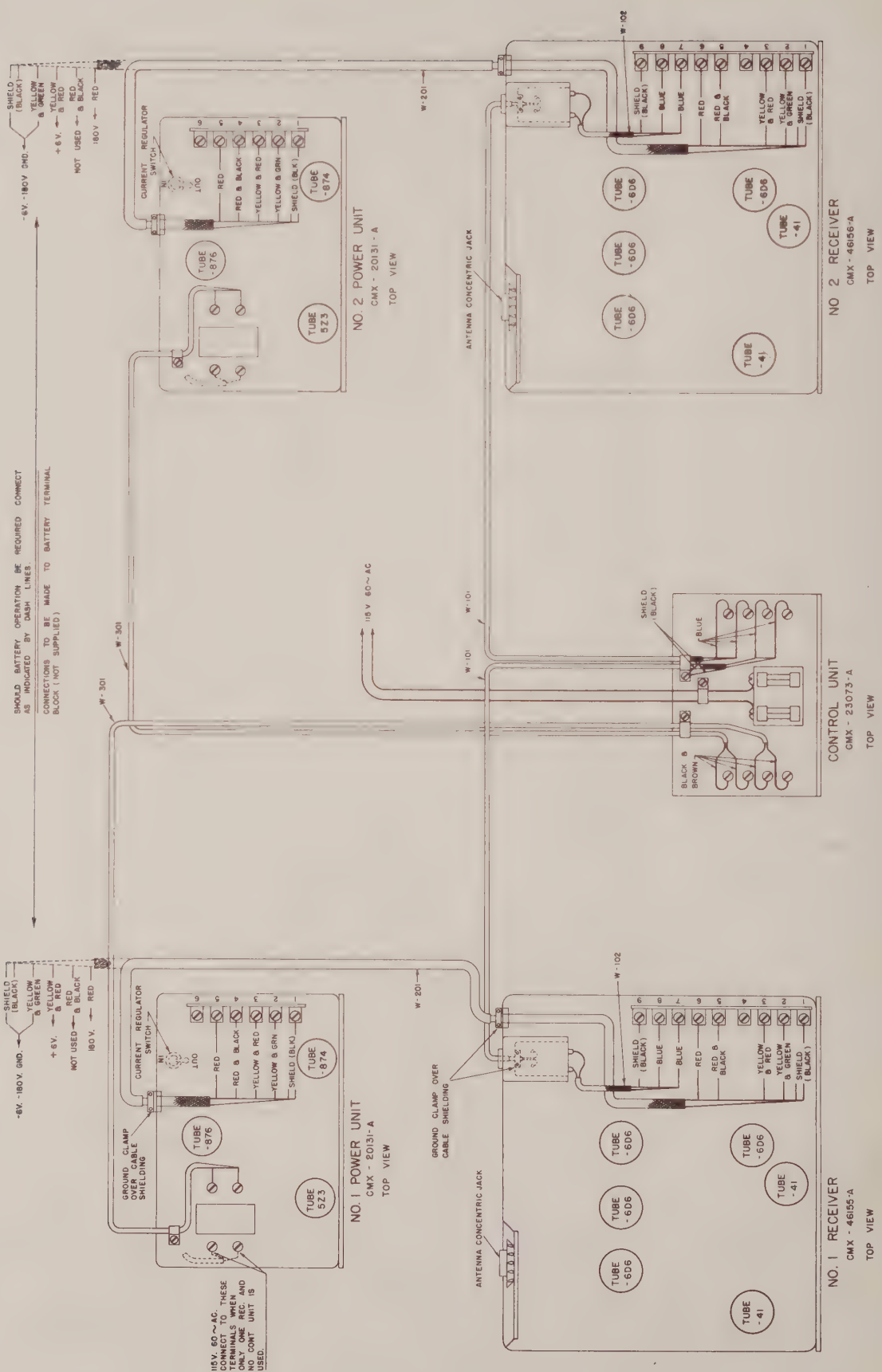
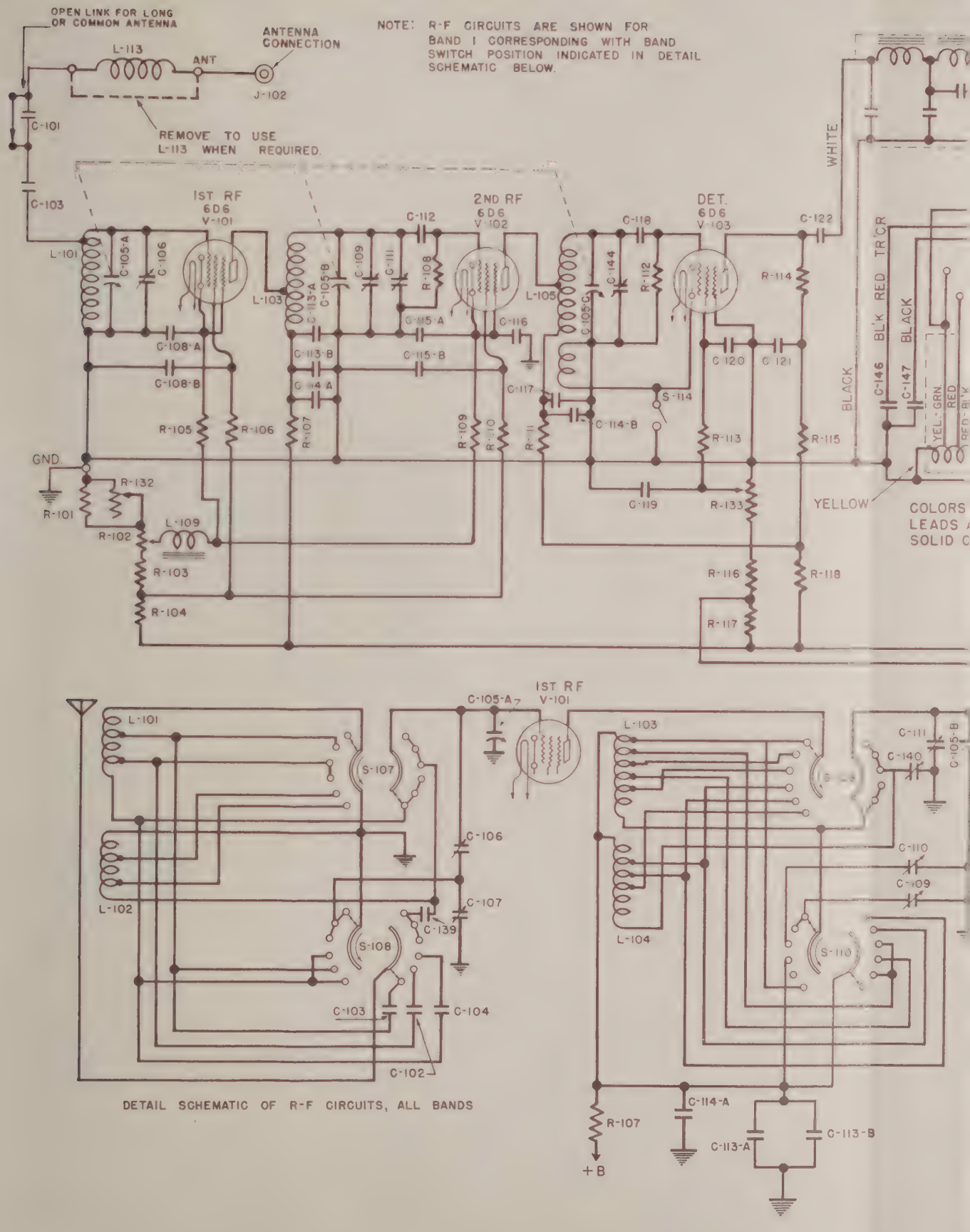



*Figure 15—External Cable Connection Diagram*




DETAIL SCHEMATIC OF R-F CIRCUITS, ALL BANDS

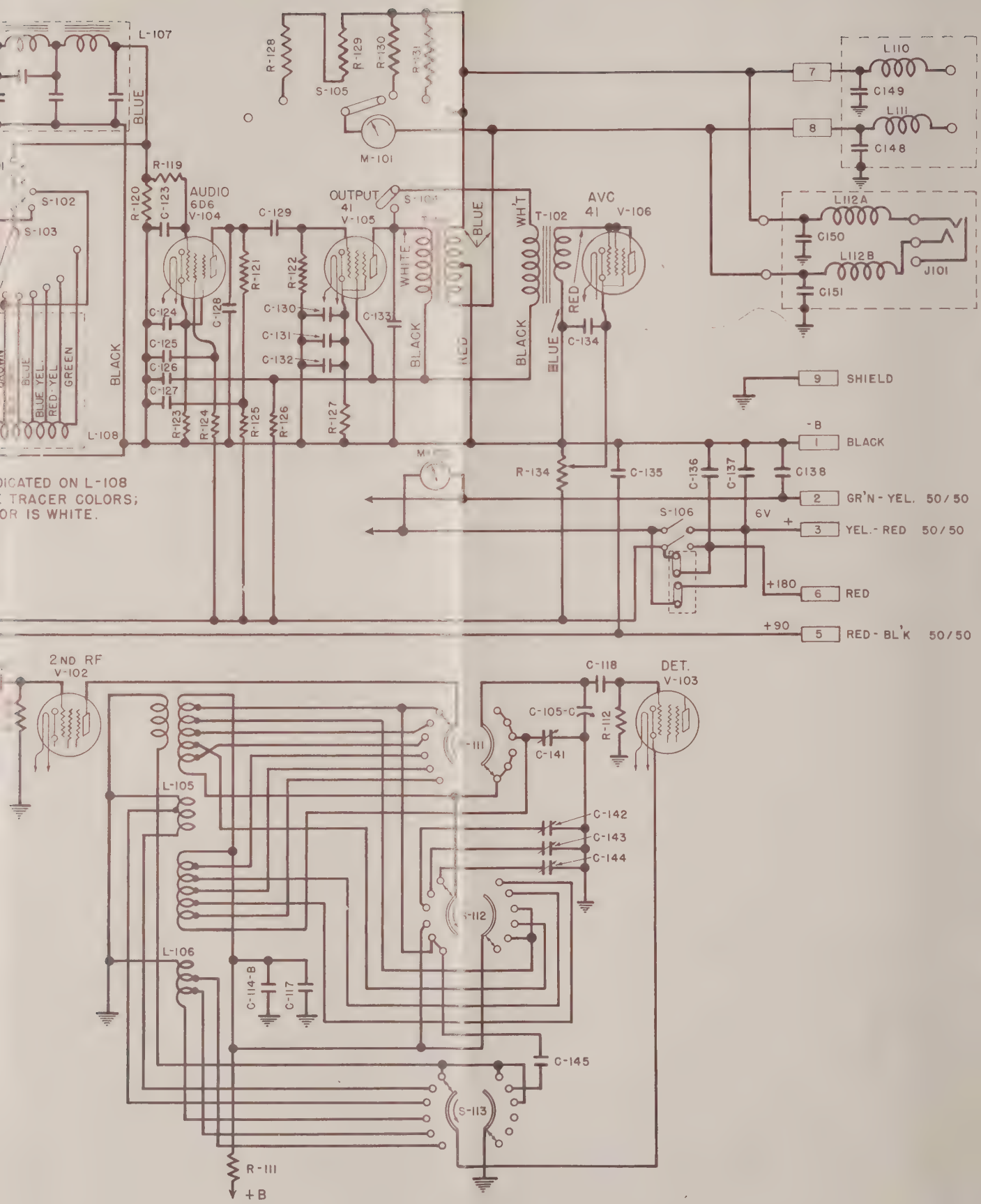



*Figure 16—Schematic Diagram, Receiver Unit CMX-46155-A*

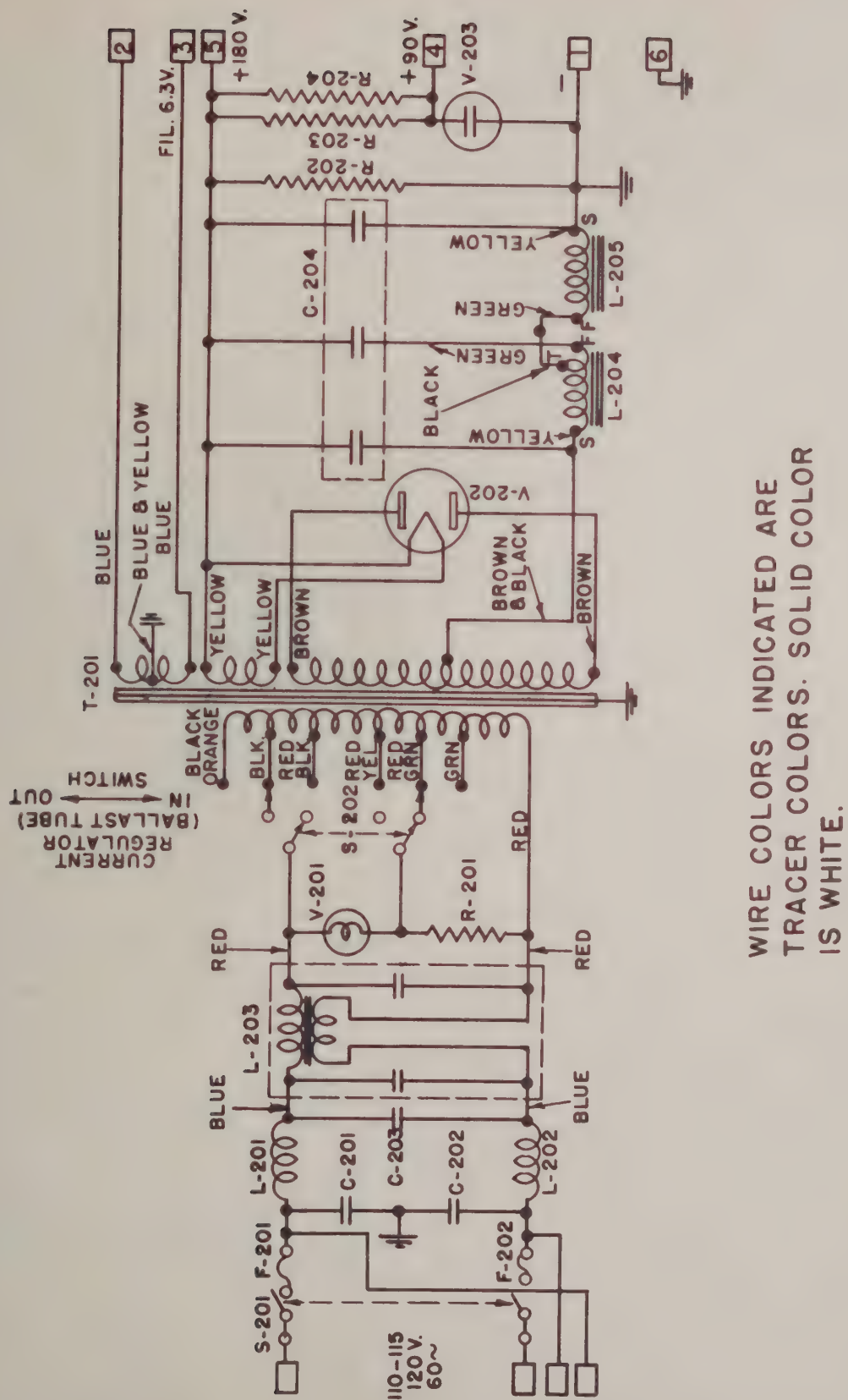



*Figure 17—Schematic Diagram, Power Unit CMX-20131-A*

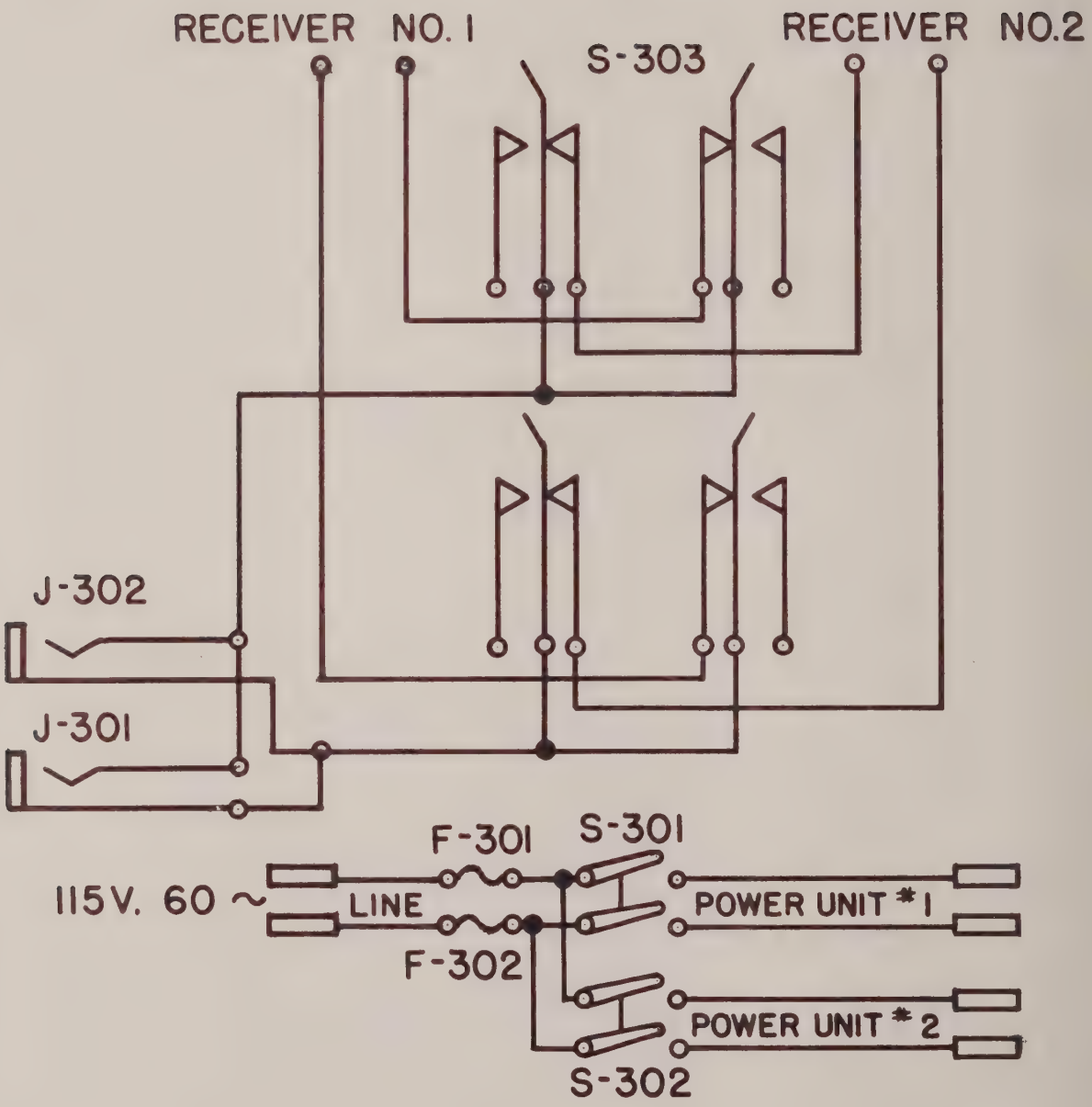
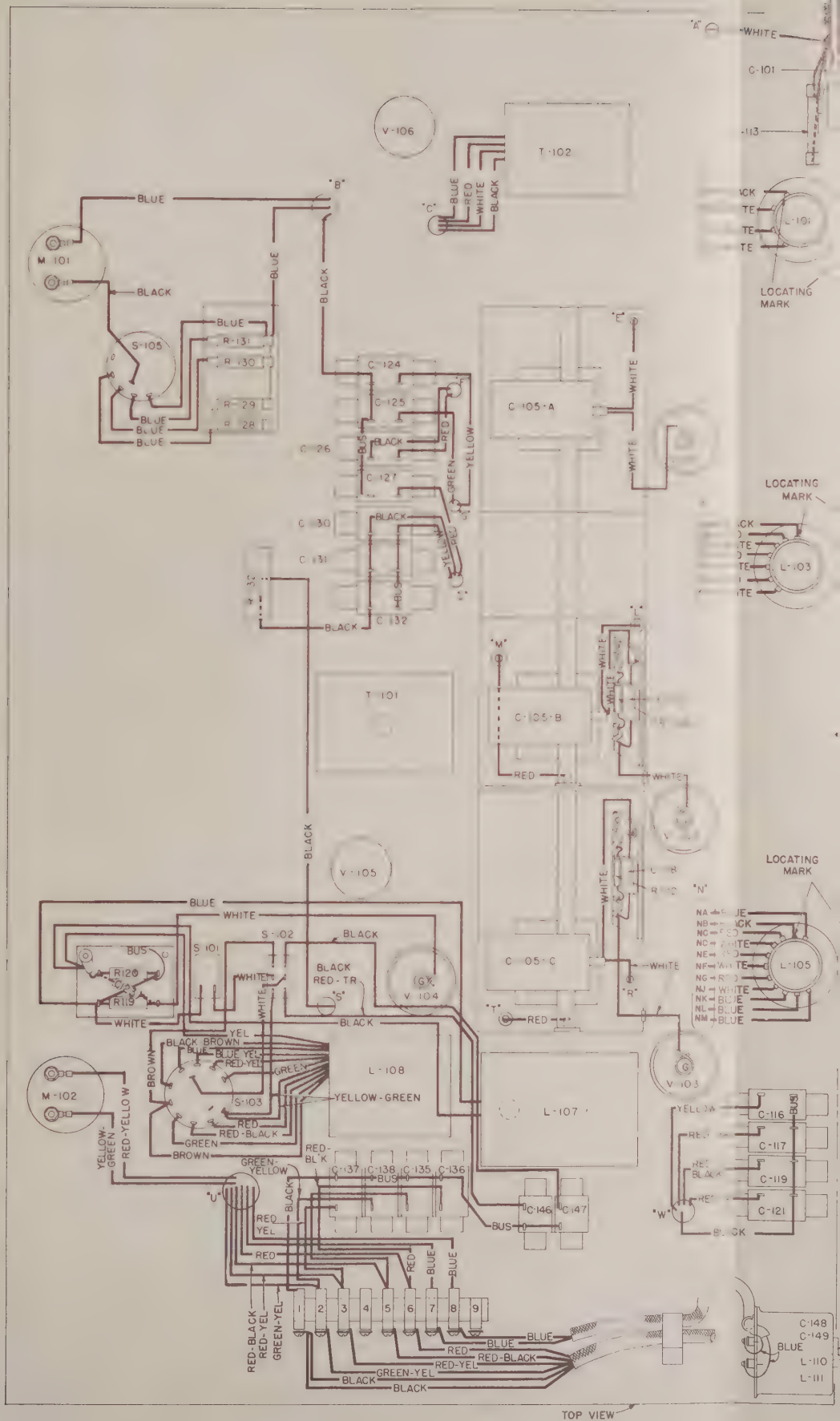
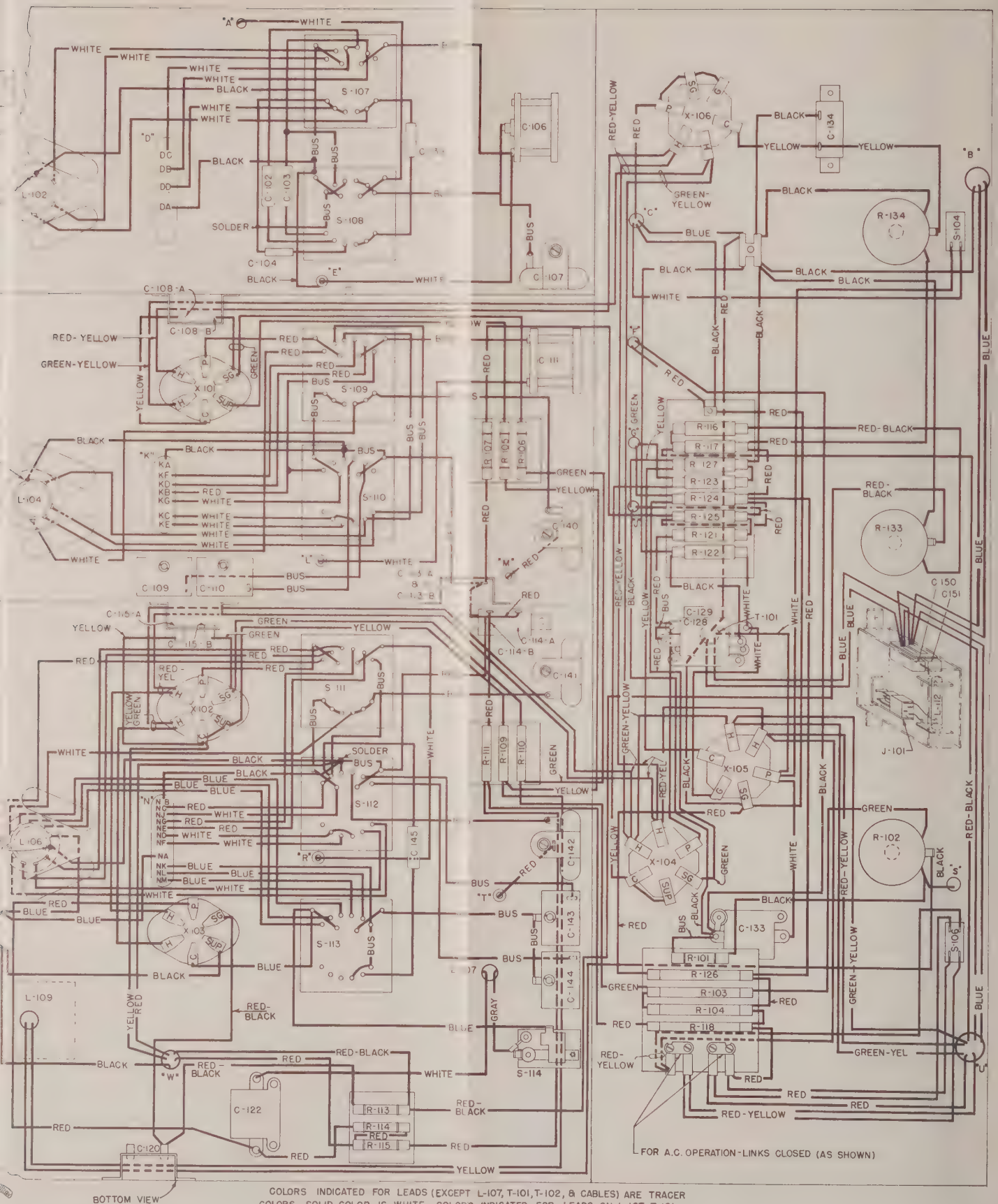


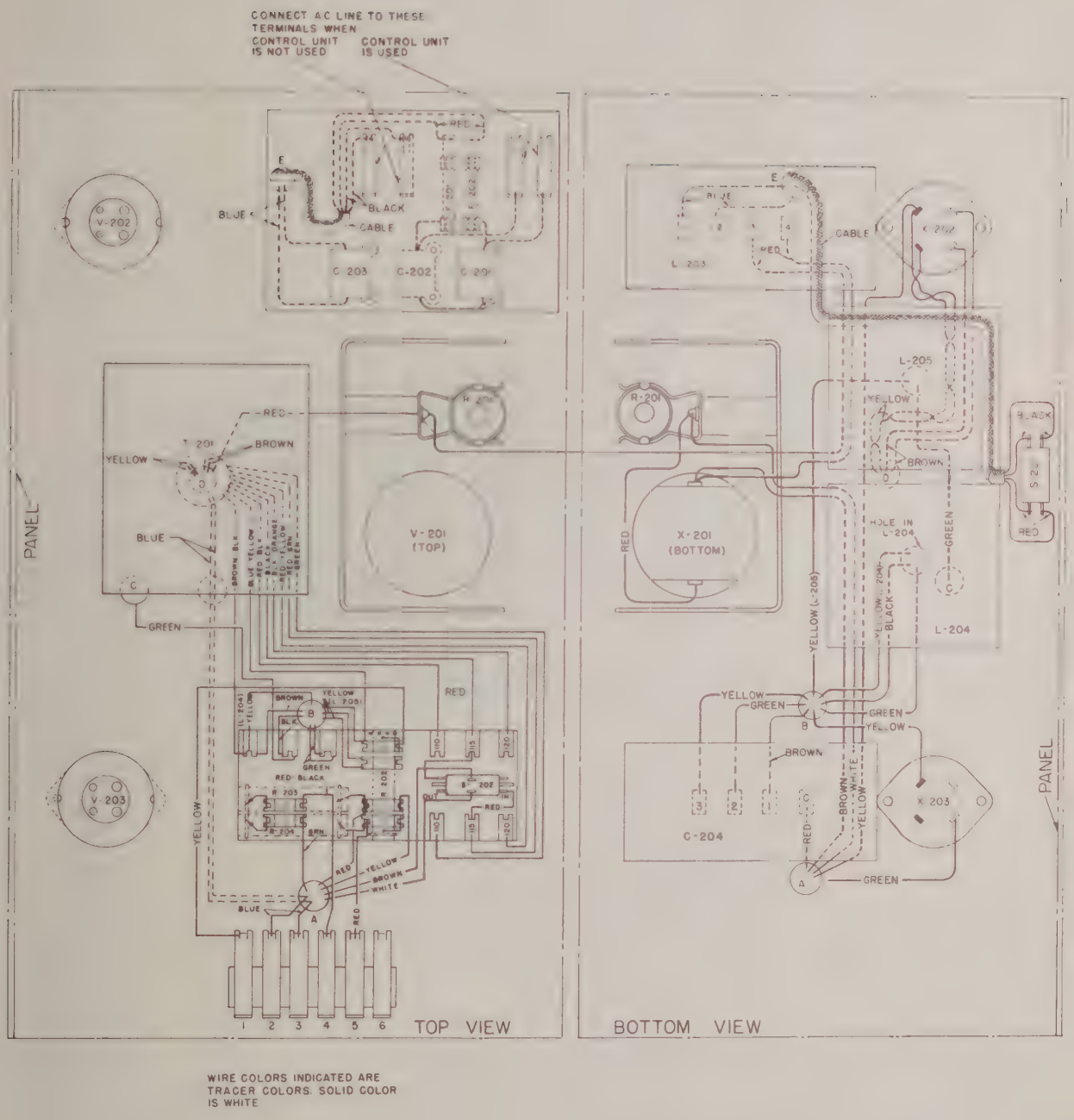

*Figure 18—Schematic Diagram, Control Unit CMX-23073-A*


V-106
T-102
M-101
S-105
R-131
R-130
R-29
R-28
C-124
C-125
C-26
C-127
C-30
C-131
C-132
C-105-A
C-105-B
C-105-C
T-101
V-105
V-104
S-101
S-102
R120
C123
R119
S-103
L-108
M-102
L-107
V-103
C-116
C-117
C-119
C-121
C-146
C-147
C-137
C-138
C-135
C-136
L-101
L-103
L-105
C-148
C-149
L-110
L-111
LOCATING MARK
WHITE
BLUE
BLACK
RED
YELLOW
GREEN
BROWN
BUS
TOP VIEW



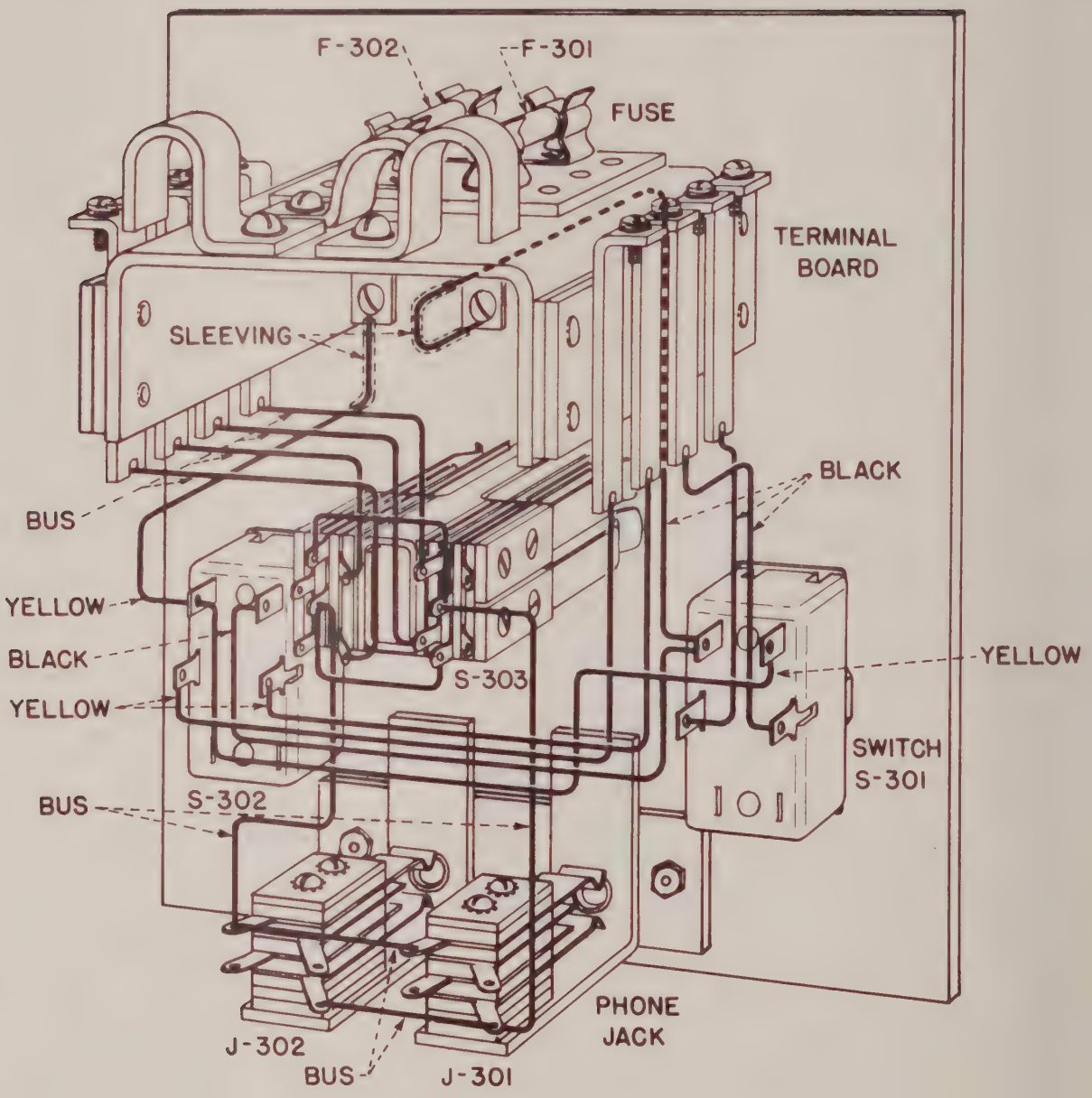

COLORS INDICATED FOR LEADS (EXCEPT L-107, T-101, T-102, & CABLES) ARE TRACER COLORS, SOLID COLOR IS WHITE. COLORS INDICATED FOR LEADS ON L-107, T-101, T-102, & CABLES ARE SOLID COLORS.

*Figure 19—Connection Diagram, Receiver Unit CMX-46155-A*



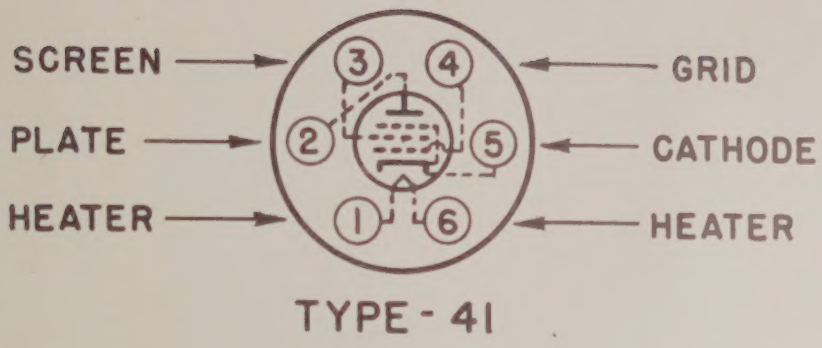

WIRE COLORS INDICATED ARE TRACER COLORS. SOLID COLOR IS WHITE

*Figure 20—Connection Diagram, Power Unit CMX-20131-A*

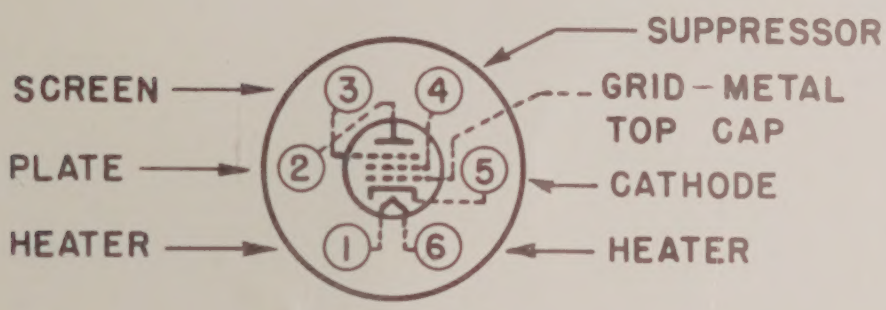



WIRE COLORS INDICATED ARE TRACER COLORS. SOLID COLOR IS WHITE.

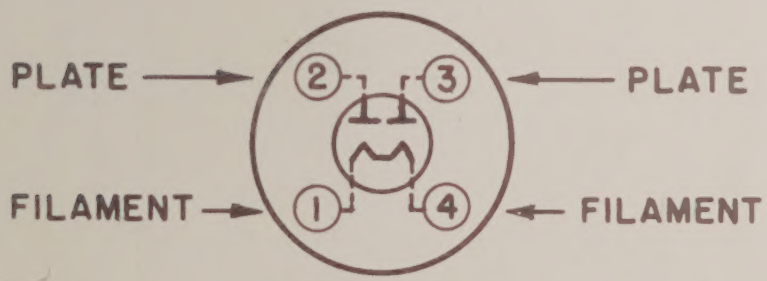
*Figure 21—Connection Diagram, Control Unit CMX-23073-A*



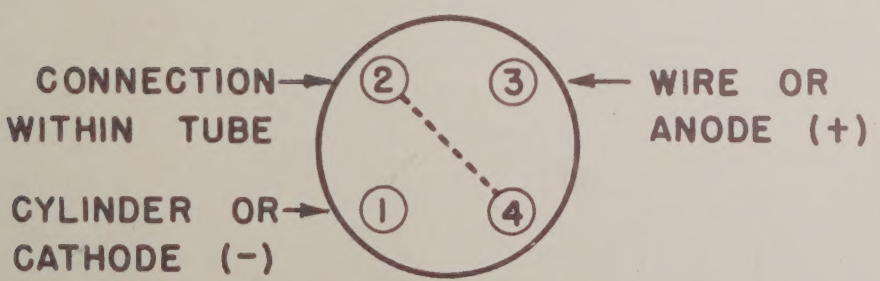

TYPE - 41




TYPE - 6D6




TYPE - 5Z3




TYPE - 874

*Figure 22—Tube Socket Connections (bottom view)*